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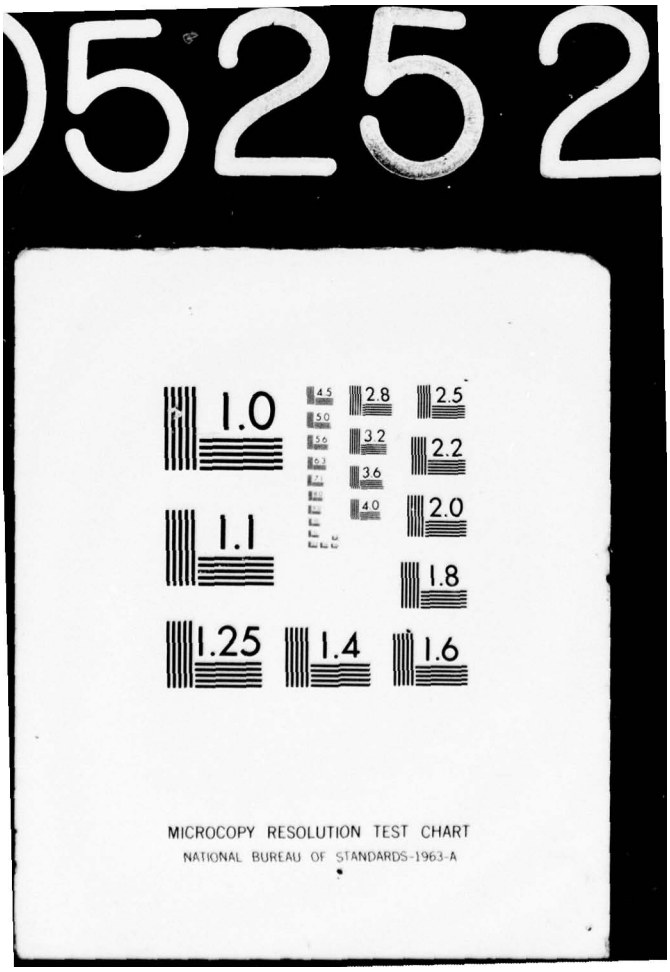
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DEPENDENCE OF THE SOVIET UNION AND EASTERN EUROPE ON ESSENTIAL IMPORTED MATERIALS YEAR 2000.

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A STUDY FOR

THE UNITED STATES NAVY PROJECT 2000

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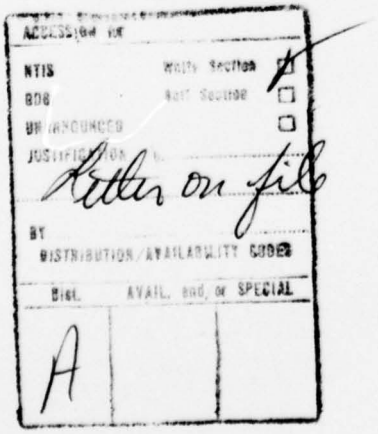

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I. SUMMARY

A. PURPOSE AND SCOPE

The purpose of this study was to analyze the dependence of the Soviet Union and the Eastern European satellites[1] on imported essential materials that will move to these countries in large quantities over sea lanes at the end of this century. It is intended as an input to the Navy's broader study, Project 2000.

In carrying out this analysis, we focused on two major questions:

- To what degree will bulk, ocean-borne imports be essential to the economy of the Soviet Union and the East European satellites in the year 2000?
- What will be the likely origins and destinations of these imports, types of ships employed, and shipping routes?

This report is the result of an extensive review of the various sources available -- both Eastern and Western. We have freely utilized work undertaken by and on behalf of many U.S. government agencies including the Department of Agriculture, Department of Commerce, Bureau of Mines, Geological Survey, U.S. Navy, Central Intelligence Agency, and Defense Intelligence Agency. In a few instances, we have identified the specific source for certain information, but in most instances we utilized numerous sources in reaching any given conclusion and did not attempt to document each step. In addition, we have employed numerous Soviet sources as well as non-proprietary in-house knowledge developed as a result of work for clients on specific projects involving activities in the Eastern Bloc and projects on which one or more of the Eastern Bloc countries could have a significant impact.

B. THE DEFINITION OF ESSENTIAL

Throughout this report, we refer to "essential" materials and "essential" uses. In previous studies of the import dependence of the United States,[2]

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1. Bulgaria, Czechoslovakia, Hungary, East Germany, Romania and Poland.
2. Dependence of the United States on Essential Imported Materials, Year 2000: A Study for the United States Navy Project 2000, Arthur D. Little, Inc., April 1974.

and Western Europe and Japan[3], an "essential" material was defined as one whose unavailability, if imports were cut off for as little as one year, would have a major negative impact on the economic, political, social or national security interests of the country or region. Essential, as used here, however, has a somewhat different meaning. In Western countries, the importation of materials usually is justified either on grounds of an economic saving or on grounds that material of equal quality is unavailable from domestic sources. If all imports were cut off from such an economy, there could be opportunities for utilizing less economic domestic sources, substituting other materials, or just "doing without" that would lessen the impact and, consequently, lessen the degree of essentiality of these particular imports.

In contrast, one of the political imperatives of the Communist doctrine is a policy of maximum self-sufficiency, rather than economic optimization as practiced in the West. To quote Kuibyshev, one of the early Soviet Ministers of Foreign Trade, writing in 1932:

> We shall undertake ... the task of making our socialist economy completely independent economically from the capitalist world ... so that we need fear neither threats nor blockades. But, of course, this does not mean that our ideal is a shut-door economy. We shall extend our foreign trade connections ... but only such as help to strengthen socialist construction and are in consonance with the complete economic independence of the USSR.

This philosophy has been continued by all succeeding ministers, admittedly more or less stringently, as happened to befit the political environment of the time. However, the penchant for economic independence has been constant.

After World War II when the Soviet Union became the mentor and model for its East European satellites, it was natural that a similar philosophy be imposed on or adopted by them and each country sought to provide "adequate" heavy industry for itself. However, since none of the East European countries is endowed with any significant variety of natural resources, the philosophy gradually was applied not to each country in isolation, but jointly to all of them, including the Soviet Union. Thus, the self-sufficiency that in theory was so desirable became interpreted as interdependency.

Not surprisingly, this also was perhaps the best single method by which to assure the long-term adherence of these nations to the Soviet version

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3. Dependence of Western Europe and Japan on Essential Imported Materials, Year 2000: A Study for the United States Navy Project 2000, Arthur D. Little, Inc., February 1977.

of Communism. In practice, adoption of this philosophy necessarily meant dependence of all the satellite countries on the Soviet Union for the majority of their raw material needs. Granted, there is some reciprocal raw materials trade, but Soviet exports to Eastern Europe dominate.

In a very real sense, therefore, virtually all foreign imported materials and products must be considered essential; otherwise they would not be permitted to enter. In this analysis, therefore, we have tried to consider all bulk ocean-borne imports that potentially are of significant volume. For purposes of this analysis, we have considered the landing of fish as bulk imports since fish are an important source of protein in the Soviet diet.

C. FINDINGS

The principal conclusion of this study is that bulk ocean-borne imports will not be nearly so critical for the economic survival of the Soviet Union alone -- and, so long as it is a member, of the Eastern Bloc as a whole -- as they will be to the economic viability of the United States, Western Europe and Japan. In fact, the results of our studies of the import dependence of these areas reveal that by the year 2000 the Eastern Bloc will be only about 20% as dependent on bulk ocean-borne imports (in terms of the tonnage received) as Western Europe and Japan, and 40% as dependent on bulk ocean-borne imports as the United States.

In view of the Soviet's almost paranoid desire for self-sufficiency and the legendary richness of its raw materials base, it is perhaps surprising that we conclude that it will have any major dependence on imported bulk materials. Indeed, the Soviets are extremely well endowed with a very large percentage of the needs of a modern industrialized society and are important exporters of a number of critical materials. But not even a paranoid desire can be filled from a physically empty storeroom and in a few cases the Soviet Union, as well as its East European satellites, has a severely limited, if not completely empty, coffer.

To provide a basis for judging the future for bulk ocean-borne imports, it is necessary first to consider how the economies of the Eastern Bloc countries are likely to grow through the remainder of this century.

The future of the Soviet and East European economies will be very much influenced by a severe shortage of labor. Such problems have already hit East Germany and Hungary, but the full force will be felt in the Soviet Union only in the latter half of the 1980's when, for a short period, the population of working age in the industrialized regions will actually decline by 1 million workers per year. The ripple effect of such a labor shortage is very difficult to trace completely through the system. However, it will at least dramatically reduce the growth of the Soviet Gross National Product from the mid-1980's through

the early 1990's. Its impact in subsequent years will be very much determined by the nature of the Soviet leadership's handling of the situation during the 1980's.

Before the labor shortage can exert its full impact, however, the Soviet Union will encounter a shortage of crude oil production that will turn the Eastern Bloc from an essentially balanced crude oil supply-demand position into one which requires substantial imports -- 1.8 million barrels per day (90 million tons[4] per year) by 1985 and 2.8 million barrels per day (140 million tons per year) by the end of the century. This shift will mean that the Eastern Bloc will satisfy only about 85% of its needs from domestic crude oil production.

These two major problems are expected to cause considerable difficulty throughout the economies of the Eastern Bloc nations during the 1980's. However, a prolonged period of this type of adversity (which these countries have not encountered before) could provide the economic incentive and the political rationalization to bring about some much-needed reforms in the practices which have been developed to facilitate living within a Communist system -- practices such as the inefficient use of workers and the resistance to development of new products which have held back progress in the past.

We are optimistic that appropriate changes will be made, not so much in the bureaucratic system itself as in the degree to which the system permits its members to optimize their own activities working within the system. If this optimism proves well founded, then in the early 1990's the Soviet Union and Eastern Europe will resume the steady growth pattern which they have exhibited in recent years and, by the end of the century, the Soviet Union -- and along with it the Eastern Bloc, for by most measures the Soviet Union comprises about two-thirds of that group -- will have a Gross National Product about 2.3 times as large as that in 1975.

Economic self-sufficiency is a basic tenet of Soviet Communism. Fortunately for the adherents to this tenet the Soviet Union, with 15% of the world's land area, is well-endowed with most natural resources. In most cases, it can supply at least its own and Eastern Europe's requirements, and often it produces enough to be a major exporter to the West. For example, the Soviet Union presently exports to the West significant quantities of crude oil, natural gas, coal, phosphate rock, potash, sulfur, manganese ore, chrome ore, copper, aluminum, zinc, titanium, platinum, palladium, mercury, magnesium, vanadium, cadmium, asbestos, and diamonds.

It is not as fortunate in geography as in geology. Simply put, the Soviet Union is too far north. As a result, about 70% of its land

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4. Throughout this report all tonnage figures are given in metric tons of 2204.6 pounds.

either is not suitable for growing agricultural crops or is limited to hardy, early-maturing crops. In part because of the climate, the Soviet Union requires five times as many farmers cultivating 50% more land to feed 10% more people than U.S. farmers more than satisfy.

The Soviet Union and her East European partners pay a price for their high degree of collective self-sufficiency; they are low-cost producers of very few commodities. In many cases, imports would be a more economic solution than the maximization of domestic production, but the cost of such imports would have to be offset by increased exports of Soviet goods to hard currency countries. This is a severe limitation that must not be minimized. For this reason, while Eastern Bloc imports will increase, we believe they will be allowed to do so only enough to relieve the strongest of internal pressures.

The following sections summarize our findings concerning those commodities which will experience such pressures and therefore will need to be imported into the Eastern Bloc over the next quarter century. Table I-1 and Figures I-1 through I-15 summarize numerically and graphically the routes and the volumes that are expected to be carried over them.

1. Energy

The Eastern Bloc is and will continue to be self-sufficient and a major exporter of coal and natural gas. However, its traditional export position in crude oil will change dramatically -- to imports of approximately 2.8 million barrels per day by the year 2000. The Eastern Bloc will continue to be more than 85% self-sufficient in petroleum during this period, however.

This conclusion assumes that the Soviet oil industry is able to overcome some formidable short-term technological and logistical problems related to crude oil production. In order to offset the declining historical reserve base, the Soviets must exploit frontier oil regions of Siberia and the Far East which are located 1,500 to 2,500 miles from the major petroleum markets in the western part of the Soviet Union. However, optimistic levels of Soviet oil production and Eastern Bloc self-sufficiency objectives will not be achieved unless oil development programs in the Soviet Union are given a high priority by the Kremlin. This measure is essential to attract and retain the scarcest items in the economy -- effective management, technical expertise, and the authority that is required to get things done in the Soviet system.

2. Agricultural Products

The various agricultural products, particularly grain and sugar, are the largest tonnage commodities imported into the Soviet Union and Eastern Europe. While they are expected to lose their preeminent

position as imports of oil into Eastern Europe become important, imports of agricultural products will continue to be the key to Soviet viability during periods of severely adverse weather conditions. During periods of normal weather conditions, imports of agricultural products are expected to total 10 million tons per year by the end of this century. Soviet crop failures, which will continue to be a major problem, will result in increased imports of agricultural products to the extent that the availability of hard currency will permit.

The principal imports of agricultural products will be grain, animal feed and sugar. During years with normal weather, the imports of grain, oilseeds and oilseed meals together are expected to average about 5 million tons, primarily from North America and the Caribbean. There will be nominal ocean-borne imports of perhaps 300,000 tons of meat and meat products from South America and Southeast Asia; 500,000 tons of fruits and vegetables, mostly from Mediterranean countries; and 800,000 tons of coffee, tea and cocoa from South America, West Africa and India. In addition, 15.5 million tons of fish and fish products are expected to be landed in Soviet and East European ports by the year 2000, the majority of which will originate in the Atlantic Ocean.

3. Aluminum Industry

After trying for many years to achieve raw material self-sufficiency based largely on low-grade bauxite and non-bauxitic materials, the Soviet aluminum industry recently has been forced to rely increasingly upon foreign sources of bauxite and alumina to support its growing requirements. While some bauxite is available from Hungary, the bulk of the bauxite and alumina required by the Soviet aluminum industry soon will come from outside the Eastern Bloc. In fact, of all the Eastern Bloc countries, only Hungary has substantial high-grade bauxite reserves. In addition to satisfying domestic requirements, the production and exportation of aluminum metal also is a method of exporting the low-cost hydroelectric power available in Eastern Siberia. As a result, by the year 2000, the aluminum industries in the Soviet Union and Eastern Europe are expected to import 6.8 million tons of bauxite and 6.7 million tons of alumina per year. These imports will come primarily from Southeast Asia, the west coast of Africa and the coast of the Mediterranean Sea.

4. Iron and Steel Industry

Although the iron and steel industry is one of the most important participants in the bulk ocean-borne shipping of the other industrially developed regions of the world, it is not in the Eastern Bloc because of the very large iron ore deposits in the Soviet Union. By the year 2000, only an estimated 9 million tons of iron ore will be imported into Eastern Europe from overseas; the rest, which will be the bulk of the increasing demand for iron ore in the Eastern Bloc, will be satisfied by Soviet production.

Imports of steel products from the West are principally of the more specialized items originating mainly in Western Europe and Japan. Line pipe presently is the single largest steel product import and an average of 1 million tons per year is expected to be imported over the next 25 years, most of which will employ ocean-borne transportation. In addition, 2 million tons per year of imported rolled steel products probably will utilize ocean-borne transportation.

5. Fluorspar

Fluorspar is one of the few industrial raw materials for which the Soviet Union relies on imports for the majority of its requirements. Consumption of fluorspar in the Soviet Union at present is estimated to be 1 million tons while the East European countries consume another 250,000 tons. Eastern Bloc production covers only about 50% of total requirements, but if Mongolian material is included, 75% of requirements is covered. Although it appears that the Soviet Union, if it wishes to, can make the Eastern Bloc self-sufficient in fluorspar by the year 2000, concentration on higher-priority commodities coupled with political considerations more likely will lead to a doubling of ocean-borne imports to 600,000 tons per year.

6. Ferroalloying Elements

Except for tungsten, the Soviet Union has adequate resources of ferroalloying elements to supply its own requirements and the needs of Eastern Europe as well. The Soviet Union is a major exporter of manganese, chromium and nickel to the West. At present, there are some imports of molybdenum, but this is believed to be a temporary shortage that should be alleviated in a few years with the completion of mine construction that is already under way. The Soviet Union's concerted efforts to become self-sufficient in tungsten are expected to succeed, but Eastern Europe will likely continue to depend on overseas sources for much of its tungsten requirements -- on the order of 25,000 tons per year.

7. Tin

Although the Soviet Union is second only to Malaysia in the mine production of tin, imports still account for 30% of Soviet tin requirements and 90% of East European tin consumption. While development of tin production in the Soviet Union will continue to receive a relatively high priority, the Soviet Union is unlikely to become completely

self-sufficient, let alone achieve self-sufficiency for the Eastern Bloc as a whole. By the year 2000, therefore, tin imports are expected to reach 30,000 tons, primarily from Southeast Asia.

8. Barite, Magnesite, Talc and Cement

The European Bloc is a net importer of barite, magnesite and talc, with a significant portion of each coming from North Korea. Barite is used primarily as a weighting agent in oil- and gas-well drilling; magnesite is used as a refractory in the steel industry; and talc is used as an inert filler in various products such as paints and rubber products. The Soviet Union probably could make the Eastern Bloc self-sufficient in barite and magnesite production by the end of the century. However, it is doubtful this will happen and it is expected that 150,000 tons per year of North Korean barite will be shipped into the Soviet Pacific Coast while 500,000 tons per year of magnesite will be shipped to the Soviet and East European steel industries. It would be more difficult to achieve self-sufficiency in talc. The fact that it is used in generally non-critical applications and that North Korea is a good source for high-grade material, militates against trying very hard. Therefore, we expect imports of talc to reach 200,000 tons by the year 2000. The Eastern Bloc is more than self-sufficient in cement, but again North Korea will likely continue to ship 500,000 tons per year to the Soviet Union, primarily to the Pacific Coast.

9. Mica

The Soviet Union is self-sufficient in scrap and flake mica, which is used principally as an inert filler in certain paints and construction materials, while the East European countries import all their scrap and flake mica requirements (3,000 tons) from India. All imports of sheet mica, which is used as a critical insulator in many electronic and electrical applications, come from India -- 2,000 tons per year into the Eastern Bloc and 500 tons per year into the Soviet Union. With the demand for sheet mica expected to decline as new insulating materials are developed, requirements by the year 2000 in the Eastern Bloc are expected to be around 1,000 tons per year, with India as the principal source.

10. Phosphate Rock and Potash

Accounting for almost one-quarter of total world output, the Soviet Union has long been second only to the United States in the production of phosphate rock and has been able to supply East European rock requirements as well as exporting some to Western Europe. Eastern Bloc demand for phosphate fertilizers grew so fast, however, that in the early 1970's the Soviet Union advised the East European countries to look for other sources for their future rock requirements. The Eastern Bloc has become

a net importer and, even assuming a doubling of Soviet production, by the year 2000 still will have to import 27 million tons of phosphate materials per year.

The Soviet Union and East Germany are major producers of potash and between them supply all Eastern Bloc potash requirements and export almost 2 million tons to the West. Reserves are extensive and potash is expected to continue to be a major Eastern Bloc export through the end of this century.

11. Natural Rubber

The Eastern Bloc is completely dependent on imports of natural rubber, as are the other industrialized nations of the world. The Eastern Bloc is minimizing its natural rubber requirements and, by 1985, will consume only one-half as much natural rubber per unit of total rubber consumption as Western producers will require. Continued conservation efforts will likely permit imports of natural rubber to be maintained at their present level of 500,000 tons per year. Essentially all natural rubber will be imported from Southeast Asia.

12. Shipping and Trade Routes

The Soviet merchant fleet, which accounts for about two-thirds of the Eastern Bloc fleet, was developed in the late 1950's to minimize the hard currency drain associated with the charter market, to insure against intervention, and to satisfy the demands of various foreign aid programs, such as those with Cuba and Egypt, that could not be entrusted to Western shipping. The rapid growth in the fleet that took place in the 1960's raised the Soviet Union to one of the major merchant marine nations of the world and has permitted more than half of all Soviet foreign trade to be carried in Soviet bottoms.

With over one-half of the world's gross registered tonnage of fishing vessels operating in virtually all major oceans, an important aspect of Soviet maritime activities is the development of a worldwide network of port facilities to which Soviet vessels have official access. The right of Soviet vessels to use the harbors, repair facilities and stores of 52 countries around the world is vital to the fleet's operations. The choice of partners for these agreements -- 52 so far -- indicates a global strategy which, besides the commercial advantages, has obvious military implications.

Another recent development is the Trans-Siberian Landbridge for containerized cargo. Inaugurated while the Suez Canal was closed, the 6,000-mile landbridge was a substitute for the 17,000-mile sea route from Europe around the Cape of Good Hope to the Far East. Having overcome initial difficulties, this system has become more successful than even the Soviets expected it to at this stage.

TABLE I-1

ORIGIN AND DESTINATION OF EASTERN BLOC BULK OCEAN-BORNE IMPORTS OF ESSENTIAL MATERIALS IN THE YEAR 2000

(million tons)

Destination/Products	Western Europe	Mediterranean	West & Northwest Africa	Southern Africa	Persian Gulf	North America, Central America, Caribbean & North Atlantic	Atlantic Coast, South America & Antartic	Pacific Coast & South America	Japan, Southeast Asia, India, Indian Ocean & Pacific Ocean	Australia	Total
BARENTS SEA:											
Fish & Fish Products	0.90					5.00	0.70		0.20		5.90
Steel Products											0.90
Subtotal	0.90					5.00	0.70		0.20		6.80
BALTIC SEA											
Crude Oil					112.00						112.00
Grain						1.40					1.40
Meat & Other Agricultural Products		0.09	0.17				0.12		0.10	0.03	0.51
Fish & Fish Products						2.00			0.10		2.10
Bauxite & Alumina		0.30				0.20	0.30				0.80
Iron Ore & Steel Products	2.50						1.00		0.20		3.70
Fluorspar	0.01			0.02		0.01			0.01		0.05
Manganese Ore		0.35									0.35
Nickel Oxide						0.08					0.08
Tungsten Concentrate									0.02		0.02
Tin	a							a	0.01		0.01
Magnesite, Talc, Sheet Mica									0.15		0.15
Phosphate Rock & Fertilizer			7.00			0.70					7.70
Natural Rubber									0.20		0.20
Subtotal	2.51	0.74	7.17	0.02	112.00	4.39	1.42	a	0.79	0.03	129.07
MEDITERRANEAN SEA											
Crude Oil		23.80[b]			4.20						28.00
Subtotal		23.80			4.20						28.00
BLACK SEA											
Grain						2.50	0.50				3.00
Sugar							3.30				3.30
Meat & Other Agricultural Products		0.32	0.20				0.21		0.15	0.10	0.98
Fish & Fish Products		0.50				2.50					3.00
Bauxite & Alumina		2.00	2.00			0.20	0.60				4.80
Iron Ore & Steel Products	0.20	2.00							4.10		6.30
Fluorspar	0.03			0.23		0.15			0.02		0.43
Nickel Oxide & Sulfide						0.07					0.07
Tungsten Concentrate									0.01		0.01
Tin	a							a	0.01		0.01
Magnesite, Talc, Sheet Mica									0.55		0.55
Phosphate Rock & Fertilizer		1.50	17.00			0.70					19.20
Natural Rubber									0.30		0.30
Subtotal	0.23	6.32	19.20	0.23		6.12	4.61	a	5.14	0.10	41.95
PACIFIC COAST											
Grain										0.50	0.50
Sugar						0.20					0.20
Meat & Other Agricultural Products		0.04	0.01				0.21		0.02	0.03	0.31
Fish & Fish Products									4.50		4.50
Bauxite & Alumina			3.20						4.00	.70	7.90
Steel Products									0.95		0.95
Fluorspar				0.02					0.10		0.12
Barite, Cement									0.65		0.65
Subtotal		0.04	3.21	0.02		0.20	0.21		10.22	1.23	15.13
TOTAL	3.64	30.90	29.58	0.27	116.20	15.71	6.94	a	16.35	1.36	220.95

[a] Less than 5,000 tons

[b] Of which 21.0 originates in Iraq and 2.8 in the Persian Gulf. In both cases crude is transported by pipeline to East Mediterranean ports where it is loaded on tankers.

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FIGURE I–1 PROJECTED IMPORTS OF CRUDE OIL IN THE YEAR 2000
(Million Tons)

FIGURE I–2 PROJECTED IMPORTS OF GRAIN IN THE YEAR 2000
(Million Tons)

FIGURE I–3 PROJECTED IMPORTS OF SUGAR IN THE YEAR 2000
(Million Tons)

FIGURE I–4 PROJECTED IMPORTS OF MEAT IN THE YEAR 2000
(Million Tons)

FIGURE I-5 PROJECTED IMPORTS OF FRUITS IN THE YEAR 2000
(Million Tons)

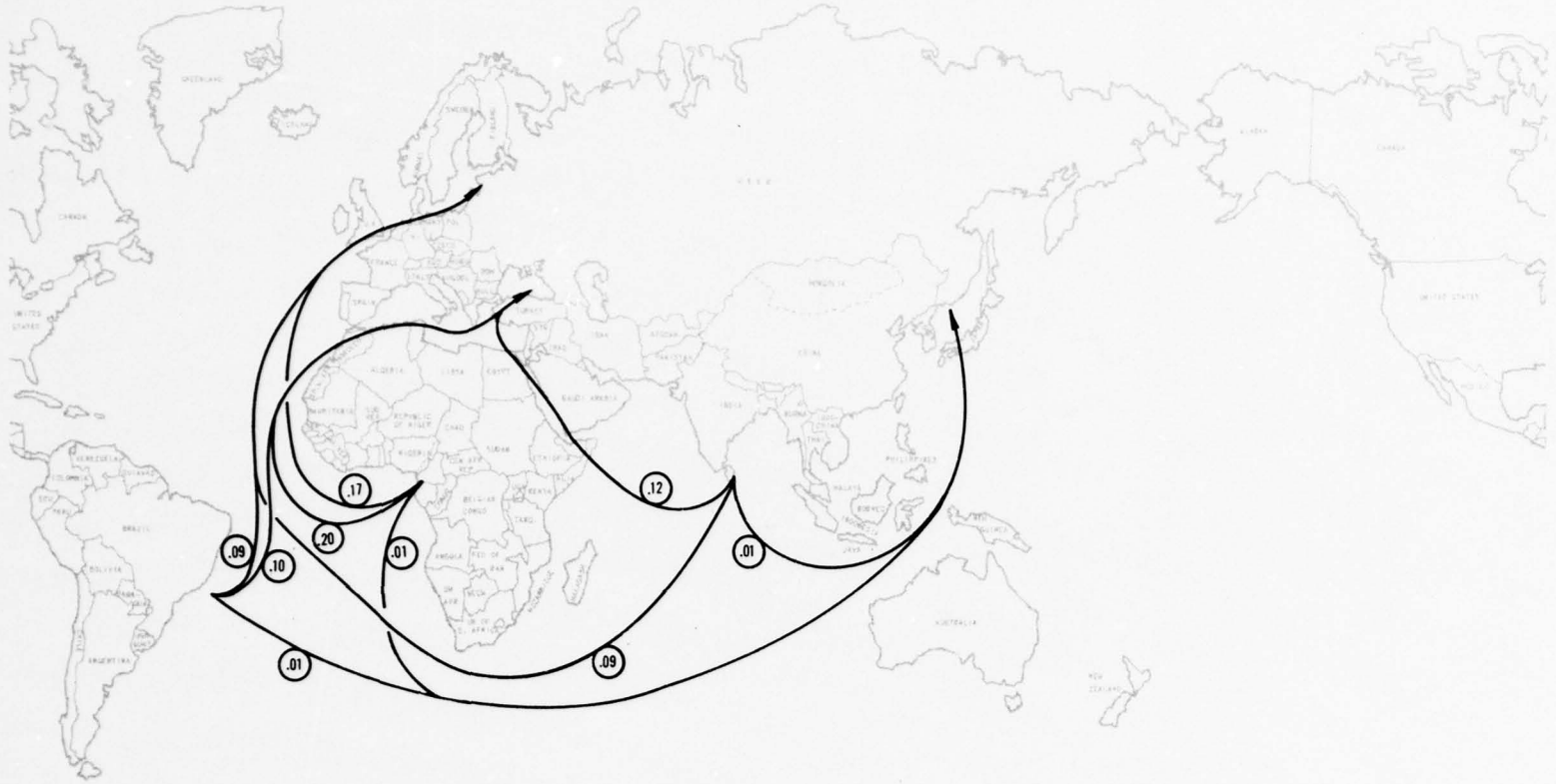

FIGURE I–6 PROJECTED IMPORTS OF COFFEE, TEA AND COCOA IN THE YEAR 2000
(Million Tons)

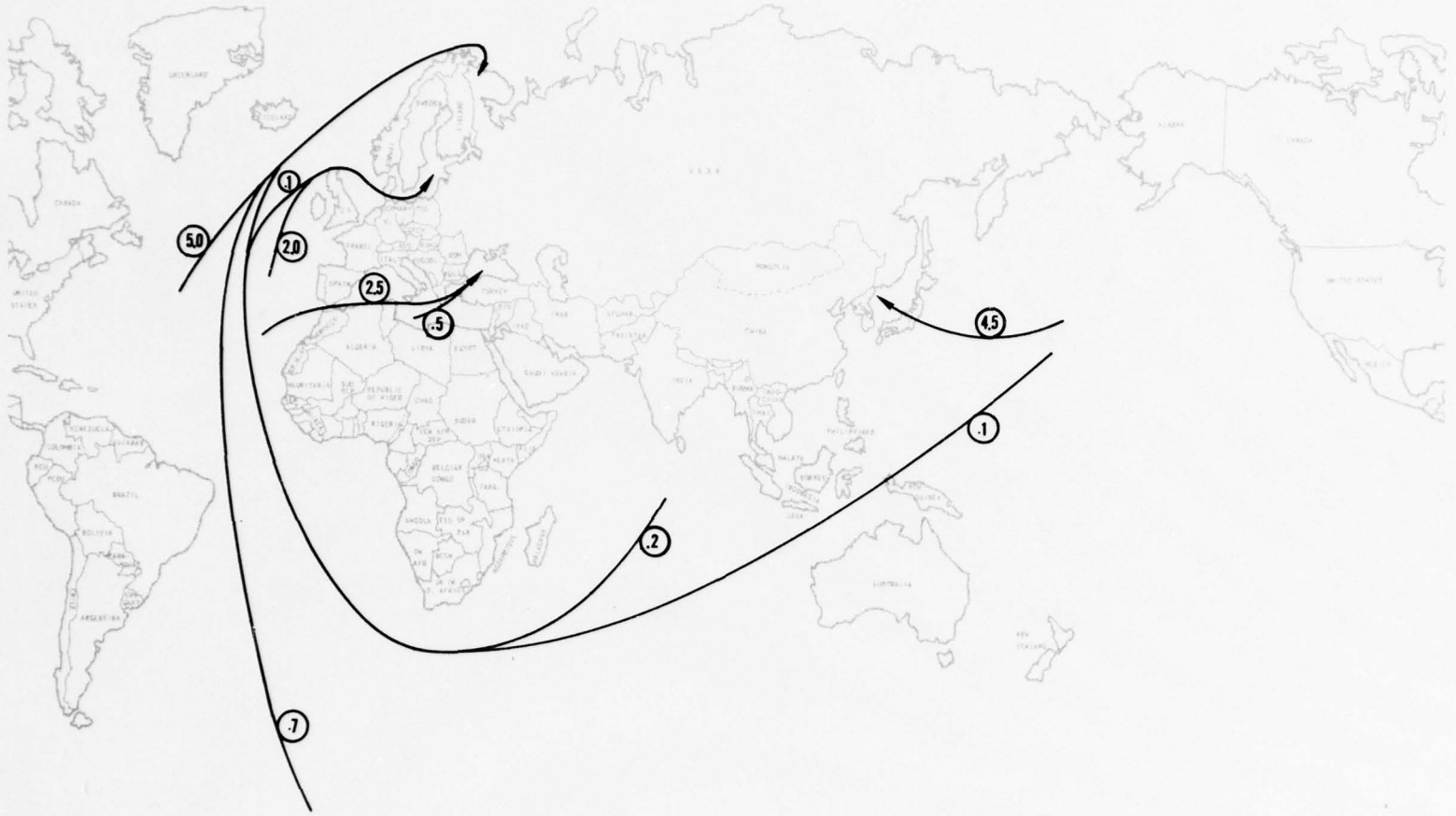

FIGURE I–7 PROJECTED LANDINGS OF FISH AND FISH PRODUCTS IN THE YEAR 2000
(Million Tons)

FIGURE I–8 PROJECTED IMPORTS OF BAUXITE AND ALUMINA IN THE YEAR 2000 (Million Tons)

FIGURE I–9 PROJECTED IMPORTS OF IRON ORE AND STEEL PRODUCTS IN THE YEAR 2000 (Million Tons)

FIGURE I–10 PROJECTED IMPORTS OF FLUORSPAR IN THE YEAR 2000
(Million Tons)

FIGURE I–11 PROJECTED IMPORTS OF FERROALLOYING ELEMENTS IN THE YEAR 2000 (Million Tons)

FIGURE I–12 PROJECTED IMPORTS OF TIN AND TIN CONCENTRATE IN THE YEAR 2000 (Million Tons)

FIGURE I–13 **PROJECTED IMPORTS OF BARITE, MAGNESITE, TALC,CEMENT AND SHEET MICA IN THE YEAR 2000 (Million Tons)**

FIGURE I–14 PROJECTED IMPORTS OF PHOSPHATE ROCK AND PHOSPHATE FERTILIZERS IN THE YEAR 2000 (Million Tons)

FIGURE I–15 PROJECTED IMPORTS OF NATURAL RUBBER IN THE YEAR 2000
(Million Tons)

II. THE ECONOMY OF THE SOVIET UNION AND EASTERN EUROPE

This chapter discusses various factors that will influence the economic growth of the Soviet Union and Eastern Europe and which will, in turn, strongly influence the magnitude of imports required by the end of the century.

To avoid semantic problems, it is necessary to define a few geopolitical terms that otherwise might be misinterpreted. Throughout this study, the following terminology has been rigidly adhered to:

- CMEA -- The acronym for the Council for Mutual Economic Assistance (often referred to as COMECON by Western sources) which consists of the Soviet Union, Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, Romania, Mongolia, and Cuba.
- Eastern Europe -- At best, an ambiguous term which has been adopted in this report along with "East European," to include only those countries of interest in this analysis; i.e., those members of CMEA that are located in Eastern Europe.
- Eastern Bloc -- Used in this report to refer to the Soviet Union plus Eastern Europe, i.e., the seven countries of interest in this study.
- Soviet -- Refers specifically to the Soviet Union; it has not been used to imply Communist ideology.
- Communist nations -- All nations that have adopted the Communist political philosophy; i.e., the CMEA plus China, North Korea, etc.
- The West -- Used interchangeably with "Western" to include all non-Communist nations. However, usually the sense is such that only the industrially developed nations are pertinent. In this context, the meaning is essentially synonymous with the term "the capitalist world" used by Soviet authors.

Throughout this report, we have attempted to reflect the economic and political realities of the Eastern Bloc. Consequently, in many cases, we have singled out the Soviet Union for special attention, sometimes almost neglecting the six East European countries. However, the Soviet Union accounts for over 70% of the population and GNP of the Eastern Bloc as a whole, so what is said about the Soviet Union often also is true for the entire Eastern Bloc. In many cases, the other members of the Eastern Bloc just tag along, if not at the whim of, at least in the shadow of the Soviet Union. Moreover, data is more easily available for the Soviet Union than it is for some of the East European countries. Furthermore, problems of omission and inconsistent reporting make the development of grand totals for the Eastern Bloc considerably less reliable than the individual country data. In addition, when a point is made by example, parallel data for each of the eight countries is not warranted. Finally, in certain cases, such as foreign aid and the

development of joint ventures in the developing nations of the world, the Soviet Union is the only Eastern Bloc country involved to a significant extent.

In many cases, we have chosen to compare the economies of the Soviet Union and Eastern Europe to those of the United States or other Western countries. Usually this is not because such comparisons are necessary to the development of the present analysis; rather, it is because many aspects of the economic activity in the Eastern Bloc are quite different from what is found in the West and often it is easier to understand comparisons than absolutes. Thus, while a farm employment of 26 million in the Soviet Union might seem high, the statement that agriculture employs 4.6% of the U.S. labor force but 22% of the Soviet labor force, a level reached in the United States in 1925, is more meaningful to most people in the West.

A. POPULATION

The slow growth rate of population in the Soviet Union and Eastern Europe (East Germany's population actually has been declining) is expected to present many difficulties to the party leaders in fulfilling their future economic plans. But the slow growth in total population is only part of the story. Because a significant part of the slowdown is a result of the declining birth rate, the average age of the population will increase, and the number of productive workers will increase at an even slower rate than the population as a whole.

As noted earlier, the Soviet Union accounts for over 70% of the total population of the Eastern Bloc. (See Table II-1.) Since its problems generally are typical of the others, its situation is worth considering in some detail.

In the Soviet Union the lack of workers already has caused most industries to be directed to increase production without increasing employment, and the 1976-80 five-year plan is being termed the "plan of efficiency and quality" to exhort workers and managers alike to improve both labor and capital utilization.

Table II-2 presents estimates of the total population and the population of working age (i.e., the theoretical potential labor force) in the Soviet Union for the last half of this century. Considering that the economic activity of any nation is a direct function of the labor force employed, and of the productivity of that labor force, it is evident that Soviet planners face a very serious problem -- in the period 1980-1995 the theoretical potential labor force will increase only 40% as fast as it did during the period 1950-1975. Although a drop in additions to the labor force occurred around 1960 (as a result of the low birth rate and high infant mortality of World War II), this was a less severe and a shorter-lived phenomenon that did not have the same impact that will be felt in the 1980's.

TABLE II-1

TOTAL POPULATION OF THE SOVIET UNION AND EASTERN EUROPE

(millions as of January 1)

	1950	1955	1960	1965	1970	1975	1980	1985	1990	1995	2000	Average Annual Growth Rate (%) 1950/1975	Average Annual Growth Rate (%) 1975/2000
Soviet Union	178.5	194.4	212.4	229.6	241.6	253.3	265.7	279.1	291.2	301.8	311.3	1.4	.8
Bulgaria	7.2	7.5	7.8	8.2	8.5	8.7	9.0	9.3	9.5	9.7	9.9	.7	.5
Czechoslovakia	12.3	13.0	13.6	14.1	14.3	14.7	15.3	15.8	16.2	16.7	17.2	.7	.6
East Germany	18.4	17.9	17.1	17.0	17.1	16.9	16.8	16.7	16.8	16.9	16.9	- .3	0
Hungary	9.3	9.8	10.0	10.1	10.3	10.5	10.8	11.0	11.1	11.3	11.5	.5	.4
Poland	24.6	27.0	29.5	31.1	32.4	33.8	35.7	37.5	39.1	40.4	41.7	1.3	.8
Romania	16.2	17.2	18.3	19.0	20.1	21.1	22.2	23.0	23.8	24.7	25.5	1.1	.8
TOTAL	266.5	286.8	308.7	329.1	344.3	359.0	375.5	392.4	407.7	421.5	434.0	1.2	.8

Source: U.S. Department of Commerce

Arthur D Little Inc

TABLE II-2

ESTIMATES OF POPULATION AND POTENTIAL LABOR FORCE IN THE SOVIET UNION

(millions, as of July 1)

		Population of Working Age[a]	
	Total Population	Total	Average Annual Increase
1950	180.1	103.3	
			2.3
1955	196.2	114.7	
			1.0
1960	214.3	119.5	
			.9
1965	230.9	124.1	
			1.5
1970	242.8	131.7	
			2.5
1975	254.5	144.4	
			2.3
1980	267.1	155.8	
			.7
1985	280.4	159.2	
			.5
1990	292.3	161.9	
			.7
1995	302.7	165.6	
			1.6
2000	312.2	173.7	

a. Males aged 16-59 and females aged 16-54

Source: U.S. Department of Commerce

The population growth rate has already started to slow down and, indeed, the 1976-80 five-year plan implicitly recognizes this fact by imposing relatively low production goals. In addition, unlike previous plans, the overall employment goals have not been made public, presumably to avoid the adverse reaction that such an announcement would generate. However, the plan for industrial employment calls for an average growth of 0.8% per year compared with 1.5% per year during the previous five-year plan.

This plan must be considered relative to the total additions to the theoretical labor force. During the 1976-80 plan, additions to the labor force will be 92% of those realized in the 1971-75 plan. Thus, industrial employment will grow only about 60% as rapidly as would have been expected based on recent past experience. This slowing has very serious implications for Soviet industry in the mid-1980's when the total additions to the theoretical labor force will drop to only 20% of the level enjoyed during the 1971-75 period.

But the full story is even more dramatic than the overall figures suggest. There is considerable disparity in the birth rates in various regions of the Soviet Union. The principal additions to the working-age population, small as it may be, will be concentrated in Kazakhstan, Central Asia (Kirghiziya, Tadzhikistan, Turkmenia, Uzbekistan) and the Transcaucasian region (Armenia, Azerbaydzhan, Georgia). In the RSFSR,[1] where the vast majority of the industrial activity of the Soviet Union is concentrated, the working-age population actually will decline throughout the 1980's -- and in the 1985-90 period that decline will average 1 million persons per year.

In theory, this part of the problem could be resolved by forced internal migration from the southern republics of the Soviet Union to the RSFSR. However, internal migration in the Soviet Union traditionally has been into the southern regions rather than out of them. With a warmer climate and an indigenous population that has failed to supply the required industrial labor, these southern regions traditionally have drained population away from the far east and north. Furthermore, the native languages in these southern republics are not Russian, making it difficult for industry in the rest of the country to utilize immigrants from the south even if they were induced to migrate north.

It would perhaps be comforting for Soviet leaders if they could retreat from such prognostications with the hope that they might not come true. However, such hopes would be myopic. In contrast to most projections,

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1. The Russian Soviet Federated Socialist Republic, or what was basically Russia before the Communist Revolution. As it is now constituted, the Soviet Union is composed of the RSFSR plus fifteen Union Republics, in theory each of which is a completely voluntary member of the Union of Soviet Socialist Republics (USSR).

population projections represent a near certainty for a considerable period into the future. For example, of the total Soviet population that will be of working age in 2000, 62% is already living and the period of most severe strain (1985-90) is one in which virtually all the participants already have been born. Even if those who believe the fertility rate is beginning to rise among younger Soviet citizens are correct, the impact on the working population will not be significant until the early 1990's.

Although the Soviet government can influence the size of the working population to some degree, many aspects are more or less fixed, at least through the most severe period of the late 1980's. Full employment in the Soviet Union is not the political slogan it is in the West; it is a mandate. Since Stalin "abolished" unemployment in 1930, all able-bodied persons, male and female, have been required to work. As a result of this policy, 93% of the males of working age in the Soviet Union are employed compared to 91% of the males in the United States. Until the 1960's female employment in the Soviet Union was about 77%, well above the 50% level of employment in the United States, but in line with the level found in other Communist countries. During the 1960's, as a result of the slow growth in the population of working age that has already been noted, the percentage of women employed in the Soviet Union rose to 89%, well above the level of all other Eastern Bloc nations. Thus, there is no sizeable pool of unemployed from which the Soviet Union can draw to meet its needs.

Another indication of the impending population pressure is that in an age when the governments of most nations of the world are concerned with limiting population growth, the Soviet Union is encouraging it. Mothers who bear and raise ten or more children are eligible for the "Glory of Motherhood" order and a "Motherhood Medal," which may or may not be a greater incentive to bear offspring than the payment of 12 rubles per month for each child age 17 or under. As already noted, however, no glorification-of-motherhood program can add to the population available to work during the 1980's.

The Soviet government could make it easier for those in the upper age brackets to continue to work. Just increasing the limitation of 300 rubles per month on total earnings of working pensioners would encourage those of above-average skill, who receive relatively high pensions, to remain actively employed where today there is a disincentive to do so. An increase of five years in the statutory retirement ages (to age 65 for males and 60 for females) would add 14 million persons to the theoretical potential labor force in 2000. Certainly, many of these would not be suitable for active work and some are already working (although they are not reported as working because of the definitions utilized). Nevertheless, retired people represent a potential addition to the labor force that Soviet planners will find it difficult to resist utilizing in the 1980's. However, the best judgment at this time is that any gains in retaining older workers will likely be offset by the

withdrawal from the labor market of some housewives[2] as a result of rising family income levels.

The number of younger workers entering employment could be increased by altering the educational requirements. However, having made an abortive attempt in this direction in the early 1960's, the Soviet government is unlikely to try it again. In fact, Soviet planners seem to be signaling their intentions in this area by calling for still further progress toward universal secondary education in the 1976-80 five-year plan.

The military is another potential source of additional workers. However, unless the concept of a universal draft is compromised, or the number of active military personnel is reduced, the potential relief available from this source is limited. In fact, during the 1980's, the armed forces will encounter the same pressure from a lack of population growth as the rest of the Soviet economy and, to keep from dropping below the current level of military manpower, the number of deferrals will have to be reduced or the length of time served will have to be increased.

Traditionally, increases in industrial manpower have come from reductions in farm employment. However, while agriculture will continue to be a source of industrial manpower, it will not supply enough to meet Soviet needs. In spite of its reputation as an industrialized nation, farm employment in the Soviet Union is still very high -- 26 million persons or 22% of the work force compared to 4.6% of the work force in the United States. In fact, it was around 1925 when agriculture last employed this much of the U.S. population. The percentage of the Soviet population engaged in agriculture has been declining steadily for many years; this trend is expected to continue and to reach 15% by 2000 -- about the same rate of reduction in agricultural employment that was achieved in the United States during the 25-year period 1925-1950. This trend means a reduction of about 10 million agricultural employees over the next 25 years. Many of them will migrate to the cities to join the ranks of industrial employees, but not enough to offset the number leaving the industrial work force.

Another alternative is to use the entire work force a greater percentage of the time by increasing the work week from its present 41 hours, or by scheduling overtime. However, either alternative has the political overtones of a desperation measure. In 1940 Stalin extended the work week from 41 to 48 hours, but the 41-hour work week was reinstated

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2. Wives who do not have to work for financial reasons are not considered unemployed, but neither are they included in the employment figures. However, wives who take advantage of the system to not work, for instance, by caring for children who could be put in child care centers, are derogatorily known as "tuneyadky", or parasites.

in the late 1950's, accompanied by vocal public acclaim. On the other hand, widespread use of overtime would be costly; the law requires time-and-a-half for the first two hours of overtime and double-time thereafter, as well as for holidays and days off. Furthermore, what is required is an increase in output, not a disproportionate increase in disposable income with its attendant increase in unsatisfied demand. Finally, foreign workers could be imported to alleviate the results of the natural population trends. This approach already is being used on a highly selective basis wherein workers, principally from East European countries, are being employed to construct facilities in the Soviet Union. For instance, portions of the Orenburg pipeline are being constructed using capital and workers from Bulgaria, Czechoslovakia, East Germany, Hungary, Poland and Romania,[3] each responsible for its own 550-km section. Imported workers, however, are not a long-term solution to the labor problem because none of the East European countries is any better off than the Soviet Union with respect to population growth, and some, notably East Germany and Hungary, are considerably worse off. Thus, they will not have surplus labor on which the Soviet Union can draw.

All of these factors taken together make it inevitable that the lack of growth in the population will put considerable pressure on Soviet planners and will be a major limitation on the growth rate of the Soviet economy over the next 25 years.

As noted above, as badly off as the Soviet Union is with respect to population growth, none of her East European satellites is any better off and most are in worse condition. Population in East Germany, which declined during the 1950's and then leveled out, is not expected to change significantly over the next 25 years. Bulgaria, Czechoslovakia and Hungary will have growth rates ranging from 0.4 to 0.6% per year. Only Romania and Poland will achieve the 0.8% per year growth rate of the Soviet Union. Except in East Germany, the population growth rate in the 1975-2000 period will be well below the rate experienced in the 1950-75 period. And, while the population pressures may not be felt so severely in the East European countries as in the Soviet Union, they still will limit potential economic growth to a significant degree.

B. PRODUCTIVITY

Because of the limitations on labor availability, labor productivity will have to increase considerably more than in the past if the Soviet economy is to continue to grow at anything close to the historic rate. If the planned GNP growth rate of 5% per year for the 1976-80 period is to be achieved, GNP per manhour worked will have to increase twice as fast as it did during the 1971-75 period (3.5% per year compared to

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3. Romania will supply capital but not labor.

1.8%). Moreover, as growth in employment slows even further in the late 1980's, output per manhour will have to rise at a rate of 4.5% per year to continue the 5% per year growth in GNP. It seems very unlikely that such high rates of growth in labor productivity can be achieved for the entire Soviet economy through 1980, let alone throughout the next 25 years.

As noted earlier, increased productivity is receiving special attention in the 1976-80 plan. Surprisingly, the increase in productivity included in the 1976-80 plan is less than that imposed by the targets of the 1971-75 plan and, in most cases, even less than actually was achieved during this previous plan period. The planned increase is large, however, when considered in light of the increase in new capital investment. Capital investment is scheduled to grow only about 25% from 1975 to 1980 compared to a 41% increase (planned and achieved) from 1970 to 1975. Although planners expect to improve capital utilization, it is unlikely to improve at a rate sufficient to offset the reduced level of investment. Imports of Western equipment will tend to improve productivity, albeit not as rapidly, or ultimately to such a degree, as the same equipment would improve it in the West. But, increases in productivity from this source will be severely constrained by the Soviet balance of payments.

As with any system, the Soviet system of controlling its economy has spawned its own peculiar set of conditioned reflexes that are designed not so much to beat the system as to permit one to live within it in the most compatible and safest manner. These responses have lead to abuses, some of which ironically can be used to advantage during the upcoming labor shortage. For example, the Soviet policy of full employment has caused plant managers of individual Soviet enterprises to hoard manpower. The traditional measure of achievement in the Soviet Union has been physical output, not the economics or efficiency of that output. Having a few extra workers minimizes the competition with other combines for new workers and reduces the dependence on newly-trained employees, both of which are hurdles to meeting the plant manager's quota. Thus, the plant manager has to worry less about a lack of labor to meet any increased output demands that are made upon him.

Another result has been the development of a system of satellite operations, serving each plant and combine, which are responsible only to their own facility. This is another form of insurance since, to the degree that such satellites can be maintained, the parent facility is independent of outside suppliers to meet its own quotas. Thus, it can control its own destiny to a much greater degree than can a facility that must depend on many other combines to meet their own quotas correctly and on time. For example, there are numerous examples of square pegs being produced to fit round holes in the Soviet Union, because either the applicable quota did not distinguish between square and round pegs and producing square pegs was easier, or the planners simply did not realize that the customer's requirements had changed from square to round pegs. Such problems are avoided when a combine develops its

own satellite facilities. Furthermore, even though the efficiency of such satellites typically is well below that of more centralized facilities designed to produce the same product, this inefficiency is of very little consequence to the plant manager if the individual satellite helps the combine to meet its quotas.

The quota system also has created an aversion to technological change. During a changeover period, at least, productivity is reduced and it is more difficult to meet the quota, but there is no commensurate reward for changing. For a Soviet plant manager, Utopia is to be called on to produce the same product, year after year, without change or innovation. If one grade of steel is more difficult to produce or has a poorer yield than another, and they both fall under the same quota, it is not difficult to imagine which grade will not be available to consumers. Without the equilibrating force of the marketplace, the quotas are supreme and about all a customer can do when he cannot obtain a needed raw material is to write letters to the newspapers -- each one in turn placing the blame on one or more of his suppliers.

If this system could be revised, many workers could be freed to fill the impending labor gap. However, it is unlikely that workers will be declared excess to anywhere near the degree required. The obvious solution which occurs to Western observers -- a free market system -- apparently is not being considered. That is no surprise since adoption of such a system would run counter to almost everything that has become ingrained in the Soviet way of life since 1916. Rather, various types of incentives are being developed wherein the monetary rewards to workers are tied to output. In some enterprises, for example, the savings achieved by reduced employment that results from natural attrition or by transfer of workers to other departments are distributed among the remaining employees.

As those looking for jobs become fewer, various incentive systems will become easier to adopt and labor will become increasingly difficult to hoard. However, a labor shortage, in itself, will have little impact on the desire of plant managers to continue to meet quotas in the manner that from their own viewpoint is optimum -- with traditional methods applied by experienced employees to produce whatever will fill the quota most easily and quickly. Without the opportunity to apply ever-increasing quantities of labor to any problem, the chances for improved productivity will increase, but improvement will not come fast enough to avoid a significant slowdown in overall economic growth of the Soviet economy over the next quarter century.

C. GROSS NATIONAL PRODUCT

Of primary concern to this study is the future of the Soviet GNP since more or less imports will be required to match a high or low GNP.

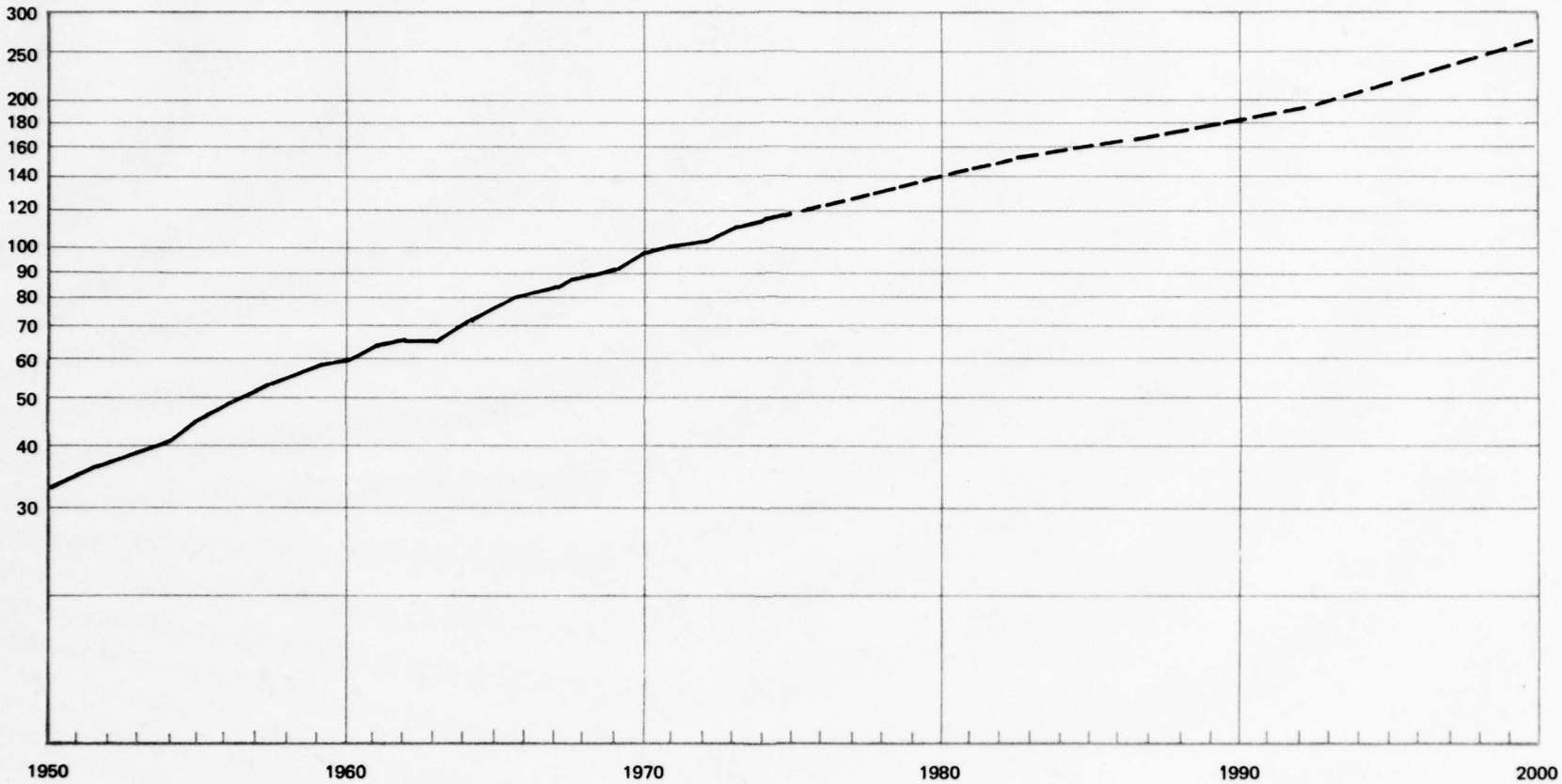
The Gross National Product of the Soviet Union has had a rather stable growth pattern over the past 25 years with only one year (1963) in which the GNP did not increase over the previous year. The growth of the Soviet GNP (utilizing the U.S. definition of GNP and employing reported and estimated physical outputs of each segment of the economy) has been calculated by Western observers. These growth rates are a little above one-half the growth rates of the officially reported Soviet national income. The results, presented in Figure II-1, reveal that the annual growth rate of Soviet GNP gradually decreased as follows:

1951-55	1956-60	1961-65	1966-70	1971-75
6.0%	5.8%	5.0%	5.5%	3.8%

Virtually all aspects of the Soviet economy affect one another. For example, population projections indicate a labor squeeze that must be made up from other sources, defense expenditures determine the growth in the civilian economy, economic aid to underdeveloped nations determines the source from which certain raw materials will be derived, and the weather influences how much grain will be imported. In theory, each of these, as well as many other factors, should be examined by anyone who is attempting to project accurately bulk ocean-borne imports over the remaining years of this century. Fortunately, however, there are also underlying conditions and limitations which significantly reduce the range of possible answers and within which it is likely that the Soviet economy will develop.

Most decisions in the Soviet Union have both economic and political aspects and most have military implications as well. For example, the Soviet merchant shipping fleet has grown rapidly in the 1970's to provide transportation for Soviet foreign trade and to reduce the hard-currency drain that chartering foreign vessels entails. But it is well known that Soviet merchant vessels are constructed to be easily convertible to military service should the need arise. Also, many Soviet factories have a dual role -- they produce goods for Soviet and East European consumers and they also produce goods for the military. Provision for converting to full military production is included from the beginning.

It is not difficult to overestimate the ability of the Soviet Union to accomplish objectives it sets for itself when one remembers Sputnik, the Soviet fishing fleet and other specific examples of advanced technological development. But such successes must be put in context. It is probably true that the Soviet Union can accomplish almost anything it sets out to do, if its goals are narrow and limited. However, it cannot implement crash development programs on many fronts simultaneously. The lack of adequate technical leadership, the limits of centralized control, and the general inflexibility and unevenness of Soviet industry prohibit all but the most highly selected targets from being attacked effectively. The Soviet Union's industrial complex, indeed, its entire economic system, is the most unevenly developed of any major industrialized



Source: Soviet Economy in a New Perspective and Arthur D. Little, Inc., estimates.

FIGURE II–1 GROSS NATIONAL PRODUCT OF THE SOVIET UNION (1970 = 100)

nation in the world. Basically, this unevenness occurred because since the Revolution heavy industry has been given preferential treatment at the expense of almost all other sectors. The result is epitomized by the fact that in 1971, the year the Soviet Union became the world's largest steel producer, Moscow, a city of 7 million people, had only twelve gasoline stations and three garages to serve the 100,000 private and over 1 million state cars registered there.

If the Soviet Union pursues its traditional policies at home and abroad, it seems inescapable that its economic growth rate will fall far short of historic trends. For a population with increasing desires (and increasing disposable income available to satisfy these desires), this situation will become increasingly intolerable. Indeed, at some point, the massive industrial complex that the Eastern Bloc in general and the Soviet Union in particular has developed will have to be turned toward the consumer. Although there was a start in this direction in the Soviet Union during the early 1970's, it now seems to have been once again abandoned in favor of building the output of basic industry to ever-higher levels.

To alter the outlook in the Soviet Union to a degree sufficient to offset the many problems that will be encountered will require changes in political philosophy that are unlikely at best. If agriculture were decollectivized, prices of all products allowed to reach levels dictated by supply and demand, and the rest of the world relied upon to supply those products which it could provide more economically, the outlook for the Eastern Bloc at the end of the century conceivably would be quite different. But the present leadership and its natural successors are unlikely to suggest such basic changes in even one of these areas, much less all of them. Probably the inevitable labor problems to be encountered in the 1980's will bring about some reforms along the lines mentioned above, but these will likely be minor modifications of the present system rather than basic changes in philosophy.

Considering all the pressures that the Soviet economy will encounter, it is reasonable to expect that the GNP of the Soviet Union will grow irregularly over the next 25 years, reaching an index level by the year 2000 of around 275 (1970 = 100). The growth rate should slow down significantly in the mid-1980's principally as a result of the labor shortage and oil shortage. It should pick up again in the 1990's as the labor and oil situation improves, building upon the improved productivity that presumably will have resulted from the shortages of the mid-1980's.

The projection of GNP given in Figure II-1 shows a growth rate in the mid-1980's very much below the rate achieved in any previous period longer than one year, while the growth rate shown for the 1990's is about equal to that achieved during the period 1965-75. This projection is intended to be illustrative of the possible trend. Whether the Soviet economy actually will slow down in the mid-1980's to the

extent indicated is not so important as the fact that the various pressures that will be encountered will make some type of slowdown virtually inevitable.[4]

The growth in the 1990's, which is still a period of labor shortage in comparison with the recent past, depends very much on how efficient the Soviet industrial facilities have been forced to become in the 1980's. The renewed growth in the 1990's probably will not be so rapid as is depicted if some way is found to lessen the pressure in the 1980's.

The pressure on the Soviet economy will be felt throughout the economies of the East European satellites. The industry and trade of these nations are so interdependent that it is virtually impossible for any of those considered in this study not to be strongly influenced, up or down, by the economy of the Soviet Union. Several of these countries already are experiencing a shortage of labor which will produce the same type of pressures as has been described for the Soviet Union. Since all six of the East European countries together account for only about 25% of the GNP of the Eastern Bloc, and since all will encounter similar problems during the 1980's, for purposes of this study we have assumed that the entire Eastern Bloc will experience the same rate of growth as is achieved by the Soviet Union.

D. ECONOMIC ISOLATION AND THE GOAL OF SELF-SUFFICIENCY

Economic self-sufficiency has been a byword of the Soviet system since the Revolution. Although principally an economic policy, it is also based on political considerations which call for independence from capitalist economies and from the unstable commodity pricing associated with the free trade engaged in by these countries. In practice, the Soviet Union has vacillated between strict economic isolation (e.g., the late 1930's) and a more moderate trade position in which foreign trade is tolerated for the benefits it can provide (e.g., the early 1970's).

The possibility that the Soviet Union could return to the isolation of the Stalin era should not be discounted. To reimpose the domestic conditions associated with such isolationism would require another Stalin-like figure who could impose his will in spite of the inevitable suffering that would follow, but if the times call for such measures, presumably a suitable leader could be found. Reimposition of such conditions might be resorted to if the country found itself under

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4. Of course, such a trend would be counteracted to a significant degree by the mobilization of forces under wartime conditions, assuming such a war is not fought in and does not affect the industrialized regions of the Soviet Union and Eastern Europe and does not require significant additions to existing military manpower.

great internal pressure which became uncontrollable by other means. The new constitution will facilitate such a move, or anything short of it, since the legalities that were mockingly recognized in the past no longer will be a hindrance.

While recognizing the possibility of a return to isolationism, we believe a stronger argument can be made for increased rather than diminished Soviet dependence on imports during the remainder of this century. First, increased trade ultimately is the more economic solution since the Soviet Union and her East European partners are low-cost producers of very few, if any, commodities. Also, use of the short labor pool can be more nearly optimized if dependence on foreign suppliers is increased than if all products must be made domestically. Obviously, consumers' demands also are more likely to be satisfied if they can obtain imported as well as domestic merchandise. On the other hand, the inability to sell inferior domestic products has already become a problem with some items.

The principal limit to the increased dependence on foreign products is the need to increase exports of Soviet goods to hard currency countries to offset these imports. This is a severe limitation that must not be minimized.

The Soviet Union can, and we believe will, capitalize on its vast natural resources to become a much more important supplier of raw materials to the West than it now is. This will require considerably greater confidence on the part of potential Western customers than they now possess, a confidence that can be instilled only by continual applications of "proper" (in Western eyes) business practices over a prolonged period.

There are indications that Soviets who recognize this fact (primarily those in the Ministry of Foreign Trade) are attempting to implement it. However, in times of reduced world economic activity (such as now), they are thwarted in their attempts by the need to generate a fixed amount of hard currency from a particular product. Thus, any advances along this route will be slow and, to proceed at all, will require understanding and resolve on the part of both Western and Soviet participants. Nevertheless, with the demand for raw materials that will be generated in the industrialized nations of the world over the next 25 years, the difficulties of dealing with the underdeveloped nations on raw materials, and the great resources of the Soviet Union, it seems more than likely that present hurdles to increased trade will be at least partly overcome.

Obviously, the foregoing does not contemplate the intervention of any major disruptive wars which would tax the military-industrial complexes of the Soviet Union or its East European satellites. Thus, expressions of control, such as the suppression of Hungary in 1956, or of support, such as the supply of equipment in recent years to various nations in the Middle East, are more or less built-in supply-demand factors that are assumed to continue at the same relative level as in the recent

past. But a major disrupting nuclear or conventional war with the United States, China, or any other nation clearly would alter the results of this study, in one direction or the other, depending on the timing and the outcome of the conflict.

Scenarios of various conflict situations and their possible outcomes could be traced through to judge the resulting net dependence of the Soviet Union and Eastern Europe on imported raw materials during and subsequent to hostilities. But, the results of such analyses, interesting as they might be, would be far more dependent on the nature of the conflicts considered and their assumed outcomes than they would on the basic import dependence of the countries involved.

Rather than considering the results of specific conflict scenarios, this study provides a background upon which to consider some of the pressures that would come into play under various conflict situations involving the Soviet Union or Eastern Europe. In this context, we have noted certain aspects of some of the ostensibly commercial activities in which the Soviet Union is engaged, particularly the development of port facilities throughout the world. Although required to support its worldwide fishing operations, the potential military implications of such facilities are obvious.

While we admittedly are rather optimistic about world politics and human nature, we have not allowed this optimism to be extended to extremes. In fact, we believe that, while imports will increase, they will be allowed to do so only sufficiently to relieve the strongest of internal pressures, but not enough to alter the overall economic trends that are projected.

In examining the import dependence for a particular commodity in 2000, we are first concerned with the possible domestic supply and demand for that product. If imports are required to satisfy the projected demand, we have tried to judge which foreign countries are most likely to be the principal suppliers. In addition, in some instances we have identified products that one of the countries may choose to produce specifically for export, and insofar as these may require imports of raw materials, we have included them in our analysis.

E. COMPOSITION OF RECENT EASTERN BLOC IMPORTS

Table II-3, which shows the sources and destinations of certain commodities imported by the Eastern Bloc in 1972, provides an overview of the import dependence of this group of nations at the present time. This data was derived from the compilation of East-West trade prepared by the United Nations based on Western export statistics. [5] It should

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5. 1972 Supplement to the World Trade Annual, Volume 1, United Nations.

TABLE II-3

PRINCIPAL SOURCES OF EASTERN BLOC IMPORTS OF SELECTED COMMODITIES - 1972

(thousands of tons)

		Importing Country						
Product	Exporting Country	Soviet Union	Bulgaria	Czechoslovakia	East Germany	Hungary	Poland	Romania
Wheat	United States	2,660	--	--	85	--	142	--
	Canada	3,600	--	--	--	--	111	--
	France	279	--	--	--	--	200	--
	Australia	524	--	--	224	--	--	--
Barley	United States	756	--	--	--	--	59	--
	Canada	515	--	--	240	--	281	--
	France	698	--	--	--	--	670	--
	Australia	78	--	--	--	--	--	--
Corn	United States	3,060	--	--	147	--	246	--
Animal Feed	West Germany	--	--	276	--	59	16	--
	Denmark	--	--	5	6	12	24	--
	Norway	--	--	--	18	13	33	--
	Netherlands	--	--	--	50	4	--	--
Fruits & Vegetables	Italy	34	--	38	46	26	34	5
	Greece	54	--	20	21	5	2	12
	Spain	13	--	25	50	3	24	--
Alcoholic Beverages	Yugoslavia	9	--	9	17	22	8	--
	Spain	2	--	3	--	8	--	--
	France	--	--	1	3	--	2	--
	Greece	--	--	--	4	6	2	--
	Austria	--	--	--	--	10	--	--
Bauxite	Yugoslavia	774	--	173	72	--	--	200
	Greece	471	--	--	--	--	--	24
Alumina	United States	215	--	--	--	40	39	--
	France	11	--	--	--	--	--	6
	Greece	8	--	--	--	--	--	46
Iron & Steel Shapes	Japan	143	--	--	--	--	--	--
	Benelux	183	--	--	--	--	41	--
	Yugoslavia	63	--	--	--	--	9	--
	Spain	206	--	--	--	--	--	--
	West Germany	30	--	--	--	--	27	--
Iron & Steel Plate, Sheet	Benelux	78	--	--	--	--	54	--
	France	107	--	--	--	--	--	--
	West Germany	241	--	70	--	--	119	--
	United Kingdom	76	--	--	--	--	48	--
Iron & Steel Tube, Pipe	Japan	150	--	--	--	--	--	--
	West Germany	642	11	65	--	--	--	--
	Italy	84	59	--	--	--	--	--
	France	--	--	--	44	--	--	--
	Yugoslavia	--	--	--	24	--	--	--
Aluminum	Yugoslavia	--	5	2	--	--	6	3
	West Germany	--	2	--	--	--	--	2
Copper	Yugoslavia	8	--	4	--	--	1	--
	Benelux	--	--	--	--	--	5	--
	United Kingdom	--	--	--	--	--	11	--
	West Germany	--	--	4	--	--	--	--
Lead	Yugoslavia	17	--	6	--	--	2	--
	United Kingdom	--	--	--	--	--	3	--
Distillate Fuel Oil	Spain	120	--	--	--	--	--	--
	Netherlands	--	--	50	--	--	--	--
	West Germany	--	--	--	--	--	32	--
Lubricating Oil & Grease	West Germany	--	--	--	--	--	31	--
	Austria	--	--	41	--	--	76	--
Crude Petroleum	Netherlands	--	--	--	1,500	--	--	--

TABLE II-3 Continued

PRINCIPAL SOURCES OF EASTERN BLOC IMPORTS OF SELECTED COMMODITIES - 1972

(thousands of tons)

Product	Exporting Country	Importing Country: Soviet Union	Bulgaria	Czechoslovakia	East Germany	Hungary	Poland	Romania
Coke & Coal	France	--	--	--	--	--	--	21
	West Germany	--	--	--	--	--	--	167
	Austria	--	--	--	--	--	--	83
	Italy	--	--	--	--	--	--	142
	United States	--	--	--	17	--	--	53
Fixed Vegetable Oil	United States	10	--	--	--	--	40	--
	West Germany	--	--	9	--	--	--	--
Caustic Soda	West Germany	--	--	38	--	67	--	--
	Switzerland	--	--	--	--	11	--	--
	Italy	70	--	--	--	4	--	--
Lead Oxide	United Kingdom	39	--	--	--	91	--	--
Other Inorganic Chemicals	West Germany	12	--	17	--	8	--	--
	Netherlands	16	--	14	--	--	--	--
	Yugoslavia	--	--	--	--	14	--	--
	Japan	24	--	--	--	--	--	--
Organic Chemicals	West Germany	35	--	18	--	15	57	--
	Netherlands	20	--	6	9	12	11	--
	Austria	21	--	6	6	12	8	--
	Italy	17	--	3	2	17	6	--
Plastics	Germany	77	--	33	--	17	25	--
	Italy	35	--	11	--	16	6	--
	United Kingdom	9	--	5	--	4	7	--
	Austria	10	--	21	--	19	3	--
Pulp & Wastepaper	Sweden	35	--	--	26	20	58	9
	United States	42	--	--	--	--	--	7
	Finland	136	--	--	27	14	9	--
	Norway	6	--	--	13	--	6	--
	Yugoslavia	--	--	--	--	--	--	24
	Canada	--	--	--	--	--	9	8
Cement	Austria	--	--	--	--	114	14	--
	Italy	--	--	--	--	92	36	--
	Spain	--	--	--	--	--	103	--
	Finland	--	--	--	--	--	164	--
Phosphate Rock	United States	--	--	--	--	--	--	400
Chemical Fertilizer	Yugoslavia	95	--	--	--	134	--	--
	Sweden	100	--	--	72	--	--	--
	Denmark	20	--	--	29	--	--	--
	West Germany	29	--	--	--	38	136	--
Shaped Wood	Yugoslavia	14	--	--	19	11	16	--
	Denmark	--	--	--	1	--	7	--
	Austria	--	--	--	--	22	--	--
Textile Yarn & Thread	Japan	--	3	--	--	--	--	--
	Italy	5	--	1	--	6	--	--
	United Kingdom	9	--	1	--	2	--	--
	West Germany	--	--	3	4	--	--	--
Nonelectric Machinery	West Germany	27	--	8	--	11	11	--
	Italy	29	--	3	--	3	4	--
	Japan	15	--	--	--	--	--	--
	United Kingdom	7	--	2	--	2	8	--
	Yugoslavia	8	--	--	--	3	2	--

Source: United Nations

be noted that a recent detailed comparison of reported Western exports to the Soviet Union and Soviet imports from the West[6] has revealed that Soviet import statistics, when they are available, tend to be a more reliable indicator of actual trade than Western export statistics. Also, data on more recent years is available for most countries. Nevertheless, because the 1972 data was already compiled on a comparable tonnage basis for all countries, coupled with the fact that we used the analysis as a screen rather than as an absolute indicator of future commodity requirements, the effort required to update this data was not considered justified.

No attempt was made at this point to isolate those imports that involved bulk ocean-borne shipments; rather, all reported exports to the Eastern Bloc nations were considered. To facilitate examination of this data, we have tabulated the source and destination for the major individual commodities for each category.[7] Table II-3 reemphasizes the relative importance of the Soviet Union in this study although in some cases, such as the importation of fruits and vegetables, it clearly does not predominate as it tends to in the case of most heavy industrial commodities.

The trade among the seven individual members of the Eastern Bloc is not included in Table II-3. Although this trade is very substantial -- for example, in 1975 over 42% of the total value of Soviet imports and 49% of the total value of her exports were associated with Eastern Europe -- it has not been of prime interest in this analysis because most of this trade involves overland transportation systems, not bulk water-borne shipments. Where such trade is important to this study, such as Soviet imports of alumina from Hungary which compete with ocean-borne overseas imports, they have been noted.

Such intra-Eastern Bloc trade has some unique aspects which should be understood because of the insight that this provides into the interdependence of all of these nations. Besides the political overtones that accompany virtually all transactions among these countries, another unique aspect involves the method of payment. The arrangement among the countries usually takes the form of credits rather than actual monetary transfers -- credits that do not get paid, but rather must be balanced, if not by exports of goods, then typically by reinvestment into new production capacity in the Soviet Union.

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6. Reconcilation of Soviet and Western Foreign Trade Statistics, ER 77-10132, Central Intelligence Agency Directorate of Intelligence, May 1977.

7. Note that we have restructured the data somewhat from the original UN compilation to better reflect the nature of the commodities involved. For example, alumina has been included under Crude Materials rather than under Chemicals as originally reported because most of the alumina imported is utilized as a raw material for the production of aluminum metal.

If all this vaguely brings to mind chain letters and the game of Monopoly, it is not surprising for there are certain similarities, the principal one being that everything proceeds relatively smoothly as long as everyone plays by the rules. The question is, in the case of the Eastern Bloc will these rules be followed for another 25 years as they have been for the past 50 years? Will the Soviet bureaucracy be able to maintain its traditional control over the population of its East European neighbors as well as its own population?

We believe the answer is yes, but to do so it will be forced to make concessions along the way that will somewhat alter the nature of the bonds that unite these nations. The established bureaucracy in each country is too numerous and has too much at stake to allow itself to risk a true rebellion, but to avoid revolt the authorities will be forced to consider each decision very carefully. And there is considerable evidence that the authorities have heeded such signs for some time now. Certainly, the apparently short-lived and abortive push for consumer goods in the Soviet Union during the early 1970's is an example, but more pertinent is what has happened in food products. In 1976 Poland experienced food shortages. Although not so severe as had been experienced in the past, the Polish people rebelled and presented their leaders with bread riots rather than submission. The leadership succumbed, quickly and without the traditional strong-arm methods. Similarly, Soviet authorities chose to import meat rather than fall further behind in their attempt to satisfy the growing demand for the food products associated with a higher standard of living. Isolated instances, perhaps, but we think they are indicative of the way Eastern Bloc politicians will tend to react in the future.

F. THE ROLE OF THE HARD CURRENCY BALANCE IN FOREIGN TRADE

Because of the many imponderables that would have to be quantified to reach a conclusion, there is little point in trying to estimate the specific hard currency balance that will prevail in the Eastern Bloc by the year 2000. It is instructive, however, to examine the trends and factors that affect the various components which make up hard currency trade and to explore their influence on the import potential over the next 25 years.

In recent years all the Eastern Bloc countries have experienced similar trends in their trade balances with the West. In each case a fairly modest growth in net hard currency imports during the 1960's (an export surplus in the case of Poland) suddenly exploded, and by 1975 the Eastern Bloc as a whole had a net hard currency deficit of $13 billion. Poland, the most extreme example, went from an export surplus of $61 million in 1970 to a deficit of $3 billion in 1975. Table II-4 summarizes the net hard currency trade in each of these countries since 1960 while Table II-5 presents the hard currency balance for the Soviet Union for the period 1972 through 1976.

TABLE II-4

ESTIMATED NET HARD CURRENCY IMPORT BALANCE[a] OF EASTERN BLOC COUNTRIES

($ millions)

	1960	1965	1970	1975
Soviet Union	97	163	435	6,281
Bulgaria	17	86	64	742
Czechoslovakia	18	43	134	573
East Germany	39	7	292	1,075
Hungary	50	59	65	747
Poland	62	(59)	(61)	3,037
Romania	3	93	206	534[b]
Total	286	392	1,135	13,000

a. Imports from less exports to developed non-Communist countries. ( ) denotes exports are greater than imports.

b. 1974 data.

Source: Central Intelligence Agency.

In the early and mid-1960's, Soviet hard currency imports and exports grew at an average of about 10% per year. The hard currency deficit resulting from this trade, which averaged about $250 million, was balanced principally by sales of gold. As a result, by the end of 1965 the Soviet gold reserves had fallen to 975 tons, only 41% of the reserves held at the beginning of 1960.

In the late 1960's and early 1970's, while imports and exports continued to rise, medium- and long-term credits on purchases of capital goods replaced gold as the principal element in financing Soviet deficits. By the end of 1971, medium- and long-term debt had grown to over $2 billion, with a debt-service ratio[8] of 18%. But, the poor harvest of 1972 forced the Soviet Union to purchase large quantities of agricultural products while its lagging industrial modernization program led to increased imports of Western technology and equipment. The results were record hard currency trade deficits of $1.4 billion in 1972 and $1.8 billion in 1973. The rise in world prices reduced the 1974 deficit slightly to $900 million, but even higher export prices could not offset the cost of agricultural imports required as a result of the 1975 agricultural disaster and the deficit was pushed to a new record of $6.3 billion in 1975 and $4.9 billion in 1976.

8. The ratio of principal and interest payments to hard currency exports.

TABLE II-5

ESTIMATED SOVIET HARD CURRENCY BALANCE OF PAYMENTS

($ millions)

	1972	1973	1974	1975	1976
Sources					
Merchandise Exports	2,815	4,818	7,630	7,800	9,900
Gold Sales	300	1,000	800	1,000	1,400
Other hard currency trade and invisibles	48	5	1,601	1,358	1,750
Medium- and long-term credits	1,030	1,690	1,710	4,300	3,950
Change in net European currency liabilities	N/A	N/A	N/A	3,171	2,000
Net errors and omissions	551	--	--	--	--
TOTAL KNOWN SOURCES	4,744	7,513	11,741	17,629	19,000
Uses					
Merchandise Imports	4,171	6,566	8,541	14,081	14,800
Interest Payments	122	157	237	456	821
Loan Repayments	451	657	890	1,280	1,762
Net errors and omissions	--	133	2,073	1,812	1,617
TOTAL KNOWN USES	4,744	7,513	11,741	17,629	19,000

Source: Central Intelligence Agency

Since 1972, the deficits have been covered by a combination of drawings on Western credits and gold sales, with the relative importance between the two depending on the interest rates offered and the world price of gold.

In the following sections we examine the individual components of the hard currency balance in the Soviet Union and comment on the long-term outlook.

1. Source of Hard Currency

a. Exports

Exports -- principally of Soviet raw materials -- are the largest source of hard currency, typically accounting for around two-thirds of the total. In 1975 and 1976, loans increased dramatically in importance, reducing exports in 1975 to 44% of the total source of hard currency, but even then exports accounted for almost twice as much as any other single source.

The composition of exports in 1973 and 1974 is given in Table II-6. The prime importance of oil exports is evident since they accounted for one-quarter of the total export value in 1973 and one-third in 1974. Exports of diamonds and metals -- principally aluminum, copper, platinum, palladium and nickel -- together accounted for nearly as much hard currency as oil in 1973, but the price increases which caused hard currency receipts attributable to oil exports to double in 1974 were not reflected to the same degree in the other products.

With the prospect for stable or declining hard currency exports of oil[9] in the 1980's, it will fall to exports of the other raw materials to pick up the slack and provide the basic source for hard currency. The CIA has projected exports of around $25 billion in 1985, 2.5 times the 1976 level, while assuming that hard currency oil exports will be slightly below those of 1976 and that non-oil exports will increase at 7.5-10% per year during the 1977-85 period. On this basis, Soviet import capacity will peak in 1980 at $16-19 billion, and fall by 1985 to $3-11 billion. If a more optimistic assumption were made on hard currency oil exports, the import capacity would rise to the $25-37 billion level projected in an earlier CIA study.[10]

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9. Arthur D. Little, Inc., and the U.S. oil industry in general are considerably more optimistic than the Central Intelligence Agency concerning the ability of the Soviet Union to control domestic oil consumption and thereby to have sufficient oil export for hard currency during the 1980's. For a discussion of this subject, see Chapter III.

10. USSR: Long-Range Prospects for Hard Currency Trade, Central Intelligence Agency, January 1975.

TABLE II-6

BREAKDOWN OF SOVIET HARD CURRENCY EXPORTS

($ millions)

	1973		1974	
	Volume	Percent	Volume	Percent
Crude Oil and Petroleum Products	1,250	25.9	2,564	33.6
Coal and Coke	135	2.8	255	3.3
Natural Gas	33	0.7	86	1.1
Diamonds	450	9.3	500	6.6
Copper	175	3.6	238	3.1
Aluminum	52	1.1	85	1.1
Nickel	200	4.2	150	2.0
Other Ores and Metals	475	9.9	582	7.6
Platinum Group Metals	260	5.4	350	4.6
Wood and Wood Products	720	14.9	1,032	13.5
Cotton Fiber	223	4.6	357	4.7
Machinery and Equipment	300	6.2	375	4.9
Furs and Pelts	67	1.4	71	0.9
Other	478	9.9	985	12.9
TOTAL	4,818	100.0	7,630	100.0

Source: Central Intelligence Agency

b. Gold

While gold is far from the principal source of Soviet hard currency, it is one of the most important because it may be utilized as required. Table II-7 presents estimates of the reserves, production and consumption of gold in the Soviet Union and Soviet sales of gold for hard currency since 1960.

TABLE II-7

ESTIMATED SOVIET GOLD AVAILABILITY

(tons)

	Reserves[a]	Production	Domestic Consumption	International Sales
1960	2,270	110	10[b]	180
1965	902	154	30[b]	500
1970	1,617	203	39	0
1975	1,972	308	43	200
1980	1,870[c]	420	48	372
1985	1,870[c]	543	53	490

[a] Year end

[b] Extrapolated

[c] Includes 50 tons rumored to have been sold to Middle Eastern countries

[d] Assuming all gold produced after 1976 is either consumed or sold

Source: Various Central Intelligence Agency reports

Gold reserves have more than doubled in the past decade, largely because gold production has increased substantially during this period, particularly in the early 1970's when two major gold deposits were developed: Zod in Armenia and Muruntau in Uzbekistan. The CIA has concluded that investment decisions already made will result in Soviet gold production expanding about 5% per year through 1985 -- from about 350 tons in 1976 to 420 tons by 1980 and 540 tons by 1985. The Soviet gold sales policy is expected to continue to be influenced by the availability and cost of Western credit and the world price for gold. However, because of the expected higher cost of Eurocurrency (short-term) borrowing and possible limitations on the total credit that will be available from Western banks (medium- and long-term borrowing), it is likely that most, if not all, of the gold available for sale (production less domestic consumption) will be marketed. According to CIA projections, sales on the Swiss and London markets plus direct sales to foreign buyers outside these markets, primarily in the Middle East, could amount to 300 tons in 1977, 335 tons in 1978, and 500 tons by 1985.

c. Other Hard Currency Trade and Invisibles

Included in this category are the net hard currency proceeds from many sources including the sale of arms, tourism and other travel, merchant shipping and other transportation as well as profits of Soviet-owned banks and firms in the West. Payments made in hard currency to the United Nations and UN-affiliated organizations, and Soviet payments of principal and interest for U.S. lend-lease agreements are subtracted from the total value. Hard currency from these sources is growing gradually, but the primary determinant of the importance of this source in the overall hard currency balance is the sale of arms, a market that in 1977-78 is estimated to yield $1.5-2.0 billion annually. The CIA expects that the continuing trend towards more sophisticated military equipment and a rising share of such sales for cash could increase hard currency from this source by as much as 10% per year.

d. Medium- and Long-Term Credits

A major share of the machinery and equipment imports has been financed through medium- and long-term credits with Western suppliers, banks and governments. While this source is expected to increase at perhaps 5% per year through 1980, there is question that it will be an increasing source thereafter. If the CIA is correct in its expectation of a decline in Soviet oil exports, potential limitations on foreign exchange earnings will increase apprehension in the West about the ability of the Soviet Union to manage an increased debt.

The attitude of the principal Western governments will be critical to the success of Soviet attempts to obtain credit. And several of these governments have begun to be concerned over the growing level of Soviet debt. For example, although major West German banks have reached their legal or self-imposed lending limits to the Soviet Union and now require government guarantees, it is likely that Bonn will continue to guarantee suppliers' credits. In view of the stiffening resistance of its traditional sources, the Soviet Union probably will draw on the $1.6 billion credit line established with the United Kingdom and the $490 million line granted by Canada.

Moscow is aware of its growing borrowing difficulties in Western commercial money markets and has attempted to locate other sources and to utilize other approaches. Considering these difficulties, it is projected that by 1980 repayment of past Soviet debt will exceed Moscow's ability to obtain new drawings, thereby essentially eliminating borrowing as a major source of hard currency, at least for a while.

2. Uses of Hard Currency

a. Imports

The importation of products from hard currency areas -- principally machinery and equipment, steel mill products and food -- is by far the most important claimant on available Soviet hard currency. The composition of these imports in 1973 and 1974 is summarized in Table II-8.

TABLE II-8

BREAKDOWN OF SOVIET HARD CURRENCY IMPORTS

($ millions)

	1973		1974	
	Value	Percent	Value	Percent
Machinery and Equipment	1,739	26.5	2,333	27.3
Rolled Steel Products	883	13.4	1,871	21.9
Nonferrous Metals	45	0.7	103	1.2
Chemicals	279	4.2	727	8.5
Rubber	129	2.0	256	3.0
Food	2,088	31.8	1,082	12.7
Manufactured Consumer Goods	202	3.1	261	3.1
Other	818	12.5	1,292	15.1
Unspecified	383	5.8	616	7.2
TOTAL	6,566	100.0	8,541	100.0

Source: Central Intelligence Agency

The CIA has found a close correlation between historical Soviet hard currency imports and economic activity in the important Western nations. This correction indicates that Soviet hard currency exports have grown

at a rate of 7.6% per year regardless of Western economic activity, while at the same time, increasing or decreasing 1% for every 1% increase or decrease in Western economies. If this correlation continues for the remainder of this century (neither the CIA nor we suggest that it could), Soviet exports would increase from their present level of 2.5% of total Soviet GNP to 10% of GNP in the year 2000. As already noted, the most recent CIA estimates have Soviet import capacity rising through 1980, but declining thereafter to $3-11 billion by 1985. We believe that actual performance will fall somewhere between these extremes and while the Soviet import capacity will tend to decline in the mid-1980's, that it will not do so to the extent suggested by the recent CIA analysis. In any case, import capacity should increase from the mid-1980's through the remainder of the century.

b. Interest and Loan Payments

Interest and loan payments include principal repayments on medium- and long-term loans obtained from Western countries mainly to finance the importation of Western machinery and equipment and interest repayment on the total Soviet debt. Principal repayment on short-term loans is not included. Although these payments are a modest percentage of the total uses of hard currency (from a low of 10% in 1974 to a high of 14% in 1976), they are a much greater percentage of the hard currency merchandise exports and it is this relationship, known as the debt-service ratio, which has become of concern to some of those considering the ability of the Soviet government to continue operating as it has in the recent past. The Soviet debt-service ratio has risen from 15% in 1974 to 26% in 1976 and the growing debt service to which the Soviet Union is already committed could consume most, if not all, of the credits that can be obtained from Western sources during the early 1980's.

3. Overview

Most authorities agree that the Soviet Union will experience a very difficult period during the 1980's in terms of its capacity to sustain imports; the discrepancies lie basically in the degree to which hard currency oil exports will be restricted, thereby impairing the import capacity. To some degree, the situation is self-regulating since a dramatic reduction in Soviet exports and imports implies a slowdown in domestic economic growth, thereby relieving the demand for imports. In any case, the import capacity is expected to increase from the mid-1980's throughout the remainder of the century. Obviously, total future imports will be limited by import capacity. However, we have assumed that the Soviet and East European import capacities will not limit imports of essential raw materials. The implicit assumption is that sufficient exports will be developed to enable required materials to be imported.

III. ENERGY

The Soviet Union has very large reserves of energy resources. It is likely that the Soviet Union itself will continue to remain self-sufficient in energy through the remainder of this century, but net petroleum imports will be required into the Eastern Bloc as a whole. Net oil imports of approximately 2.8 million barrels per day (140 million tons per year) by the end of the century are expected -- approximately 14% of total projected Eastern Bloc petroleum requirements at that time.

A. ENERGY SOURCES AVAILABLE

Based on information currently available, the reliance of the Eastern Bloc on imports of energy sources other than petroleum seems highly improbable through the remainder of this century:

- The Sovet Union, with gas reserves of 643 trillion cubic feet, contains approximately one-third of the world's presently known natural gas reserves, which represents a 50-year supply at current rates of extraction.

- With total reserves estimated at 476 billion tons and 1975 production of 695 million tons, Soviet coal reserves are even more plentiful than its natural gas reserves, with over 600 years' supply at the current rate of exploitation.[1]

- Uranium reserves are ample in the Soviet Union and Czechoslovakia for planned conventional nuclear power plants while breeder reactor development is a high-priority effort.

- There are numerous locations in Eastern Siberia where large hydroelectric power stations can be constructed. The very low cost electricity produced from this 100% renewable resource is expected to supply 2 to 4% of total Soviet energy requirements over the next 25 years.

As shown in Table III-1, the contribution of oil to the total domestic energy in the Soviet Union is expected to decline from 36% to approximately 20% by the year 2000. Although increasing emphasis will be put on industrial coal consumption, coal also is expected to decline in relative importance. This reduction in dependency on petroleum and coal must be offset by increased use of other abundant natural resources.

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1. While the Soviet Union imports 10 million tons per year of coal and 1 million tons per year of coke from Poland (by rail), it exports 10 million tons per year of coal and 1 million tons per year of coke to the West. Although Romania recently signed a 30-year contract to purchase 420,000 tons per year of metallurgical coal from the United States, with an option to purchase an additional 360,000 tons per year, if it became necessary these requirements could be supplied by the Soviet Union which has been the principal source of such imports in the past.

The natural gas grid is being expanded and the Soviet Union is planning to have a large number of fast breeder reactors for power generation in the western part of the Soviet Union by the late 1980's. While this expectation seems highly optimistic, it is likely that nuclear power generation will increase significantly by 1990 and accelerate in subsequent years.

TABLE III-1

ENERGY PROFILE OF THE SOVIET UNION

	% of Total Soviet Energy				Projected Average Annual Growth Rate (%)	
	1975	1980	1990	2000	1975-1980	1981-2000
Oil	36	35	31	20	5.0	2.4
Natural Gas	25	31	41	40	10.3	6.2
Coal	34	29	21	12	2.3	0.4
Nuclear	1	1	4	26	5.6	23.5
Miscellaneous	4	4	3	2	5.6	1.3
TOTAL	100	100	100	100	--	--
Total Soviet energy consumption (million barrels per day of crude oil equivalent)	19	25	40	65	5.6%	4.9%
Total Eastern Bloc energy consumption (million barrels per day of crude oil equivalent)	27	34	51	82	4.7%	4.5%
Soviet % of total Eastern Bloc energy consumption	70%	74%	78%	79%	--	--

Source: Arthur D. Little, Inc. estimates.

B. OIL

1. Supply

With reserves of 60-100 billion barrels[2] of crude oil, the Sovet Union currently is the world's largest crude oil producing country with an estimated 10-15% of the total world reserves. As shown in Table III-2, the other six Eastern Bloc countries are relatively

2. $A+B+C_1$ crude reserves, excluding potential offshore reserves.

insignificant crude oil producers with only slightly more than 4% of the total Eastern Bloc petroleum reserves and current production.

TABLE III-2

EASTERN BLOC CRUDE OIL PROFILE

	1976 Reserves (million barrels)	% of Total Reserves	Production (thousand barrels per day)	% of Total Production
Soviet Union	78,100	95.74	10,500	96.96
Romania	2,382	2.92	265	2.45
Hungary	1,000	1.23	38	0.35
Poland	60	0.07	8	0.07
Bulgaria	16	0.02	6	0.06
Czechoslovakia	12	0.01	4	0.04
East Germany	11	0.01	8	0.07
TOTAL	81,581	100.00	10,829	100.00

Sources: Petroleum International Encyclopedia; World Oil; Oil & Gas Journal.

Over the next decade, the production of crude oil by the Soviet petroleum industry will be limited by logistical and technological constraints rather than by a deficiency in ultimately provable crude reserves. The problem of supplying oil in the Soviet Union is similar to the problem associated with the extraction of western coal in the United States. Over 80% of the ultimate petroleum reserves in the Soviet Union are located east of the Ural Mountains in the extremely severe climate of Siberia. However, 80% of the petroleum demand in the Soviet Union is west of the Urals. The Soviets must therefore transship a continually increasing volume of Siberian petroleum 1,500-2,500 miles west to the demand centers in European Russia. In the 1980's, the contribution of the Siberian fields will increase from their current 25% to over 50% of the crude oil produced in the country, as shown in Table III-3.

A recently released CIA report concludes that the Soviet crude production will reach a peak of 11-12 million barrels per day in the early 1980's and then decline. Although this is a much more pessimistic projection than that made by some other Western intelligence agencies, there is general agreement that in the last few years, new reserve additions have not kept pace with oil production. From 1974 to 1975, oil production increased 7%. However, the addition of proven new reserves does not appear to have grown as rapidly as production and in 1976 and 1977 (for the first time in 15 years) geologists failed to meet plan targets for exploration of new deposits in the Tyumen region. The resulting declining trend in the reserve-to-production ratio is expected to continue through the late 1980's as a result of the following factors:

TABLE III-3

SOVIET PRODUCTION OF CRUDE OIL[a] BY REGION

(million barrels per day)

	1970	1975	1980 Goal	1980 High	1980 Low
Total	7.06	9.82	12.80	11.8	11.0
Western region and Urals	5.80	6.00	5.71	5.6	4.9
Urals-Volga	4.17	4.50	NA	4.1	3.5
Tartar	2.01	2.07			1.5
Bashkir	0.81	0.81	2.85	2.9	0.6
Kuybyshev	0.70	0.69			0.5
Perm'	0.32	0.45	0.62	0.6	0.5
Orenburg	0.15	0.24			
Lower Volga	0.14	0.14		0.6	0.4
Udmurt	0.01	0.07			
Saratov	0.03	0.03			
Belorussia	0.08	0.16	1.74	0.2	
Caucasus	0.69	0.47		0.3	
Azerbaydzhan	0.41	0.35		0.4	1.0
Ukraine	0.27	0.23		0.2	
Other	0.03	0.07		Negl	
Komi and Arkhangel'sk	0.15	0.22	0.50	0.4	0.4
Eastern region	1.26	3.82	7.09	6.2	6.1
West Siberia	0.63	2.96	6.16	5.2	5.2
Central Asia	0.58	0.82	NA	0.9	0.8
Mangyshlak	0.21	0.40	0.54		
Emba	0.05	0.08			
Turkmen	0.29	0.31	0.28		
Other	0.03	0.03			
Sakhalin	0.05	0.04	0.11	0.1	0.1
Other	Negl	Negl			

a. Including gas condensate.

Source: Central Intelligence Agency.

- Soviet oil producers rarely practice generally accepted industry conservation measures. This has resulted in severe water encroachment in the current producing fields following massive water injection programs that were implemented in order to boost short-term oil production. In effect, increasingly larger quantities of water must be lifted with every barrel of oil produced. At present only 110 of the 360 producing fields have a natural water drive.

- Soviet petroleum managers operate under a motivational system with strong pressures to meet annual production objectives even at the expense of long-term gains. Thus, heavy emphasis is placed upon production drilling at the expense of both exploratory drilling and oil field conservation practices.

- The extraction costs in Siberia are extremely high as a result of the climate, the required infrastructure, and the massive logistical requirements. Petroleum exploration in Siberia can be carried out only in the winter months when temperatures reach -80°F and winds sometime exceed 90 miles per hour. In the springtime, the Siberian tundra turns into a vast sea of mud.

  The current Soviet petroleum plans call for a doubling of Siberian production by 1980 although the CIA believes it is unlikely this goal will be achieved, and that there will be a shortfall of 500,000 barrels per day from the planned production goals.

- The Soviet Union will continue to be plagued by logistical snags in their transportation system as crude supply sources increasingly are shifted to the frontier areas. Although the Soviet Union currently lays more large diameter pipeline than any other country, the supply of line pipe has not kept up with a dynamic Soviet demand despite the high level of line pipe imports. Continued delays in satisfying the increasing requirements for pipeline capacity, pumping stations and surge tank facilities will further limit the transshipment of newly-developed reserves in Siberia to the marketplace.

- Lastly, the Soviet oil industry will continue to be hampered by a relatively low level of petroleum industry expertise over the next decade. Over 80% of the current Soviet rigs are turbo drills which are very inefficient, especially drilling in deep wells. For example, the Soviet Union has approximately the same number of active rigs as the United States, but drills only 20% of the footage achieved by U.S. drillers. In 1975, for example, 174 million feet were drilled in the United States while only 170 million feet were drilled in the Soviet Union from 1971 to 1975.

The relatively low level of petroleum technology also is evident from the insignificant contribution of deep drilling and offshore wells to the Soviet crude supply. Only four of the 1,800 active rigs in the Soviet Union are utilized offshore. Furthermore, compared to the United States, for example, on average Soviet oil is recovered from relatively shallow-lying formations. Over 90% of the current Soviet producing formations are located at 7,500 feet or less compared to 81% in the United States and only 2% of the Soviet producing formations exceed 10,000 feet while 8% of U.S. producing formations lie below this level (Table III-4). Through the mid-1980's, offshore and deep well crude oil production is expected to remain at less than 5% of total Soviet production unless there is a significant importation of Western technology.

TABLE III-4

THE DEPTH OF SOVIET PRODUCING OIL WELLS - 1975

	% of Total Production	
Well Depth (Feet)	Soviet Union	United States
up to 7,500	92	81
7,501-10,000	6	11
over 10,000	2	8
	100	100

Source: Defense Advanced Research Projects Agency.

While constraints on oil production in the Sovet Union may loom on the immediate horizon, the ultimate reserve base for the crude oil needs of the country appears to be sufficient through the end of the century. However, it is most likely that net imports will be required into the Eastern Bloc in the year 2000 to satisfy the incremental crude demand of the East European countries over their current demand level.

As in the United States, all of the easily extractable oil fields have been found and are currently being exploited. However, approximately 75% of the Soviet land mass has sedimentary strata in which oil could be found. Furthermore, current production in Western Siberia is highly concentrated, with 60% of the production coming from the giant Samotlor oil field. This field, which covers approximately 300 square miles, has approximately the same magnitude of crude reserves as the U.S. North Slope (i.e., 9 to 15 million barrels of potential recoverable reserves). Most of Eastern Siberia and the Far Eastern republics of

the Soviet Union have yet to be carefully explored geologically to any significant degree. As stated previously, production from offshore and deep well drilling is relatively insignificant. Thus, it seems quite reasonable that the potential crude reserves in the total Soviet Union hardly have been scratched. The volumetric magnitude of ultimate oil reserves is speculative at best, but some industry sources have estimated that the Soviet Union could contain over 25% of the ultimate world petroleum reserves (i.e., over 400 billion barrels out of 1,700 billion barrels).

The crucial question that will determine to what degree the Eastern Bloc must depend on imported oil is how many giant oil fields actually are uncovered and exploited in Siberia by the end of the century. Industry sources estimate that to offset declining production in existing producing fields of the Soviet Union, at least a dozen fields similar to Samotlor, or the equivalent, must be discovered and completed by the year 2000. As a result of the technological and logistical impediments discussed previously, production from such new fields would not take place before the late 1980's. But in the long run, i.e., by the year 2000, we believe it is reasonable to assume that the production and transportation technologies required by the Soviet oil industry will be imported or developed internally if given sufficient priority by the Kremlin. And, if the extreme pressures on Soviet oil production projected by the CIA come to pass, it is likely that the oil industry would be given the highest priority.

2. Demand

As shown in Table III-5, the total Eastern Bloc petroleum demand in 1975 was over 8.5 million barrels per day, which is about 50% of the total petroleum consumption in the United States.

The Soviet Union accounts for approximately 80% of both total Eastern Bloc refining capacity and petroleum demand. In 1975 the Eastern Bloc had a net surplus refining capacity, which permitted approximately 500,000 barrels per day of refined product to be exported. All of the Eastern Bloc countries have sufficient indigenous refinery capacity except for Poland and Bulgaria where product imports are required, primarily from other Eastern Bloc sources. It has been assumed that the Eastern Bloc as a whole will continue to have sufficient indigenous refinery capacity in the future. However, all of the East European countries are crude short and imported over 80% of their crude needs (1.5 million barrels per day) in 1975. Approximately 13% of the Eastern Bloc crude imports (190,000 barrels per day) were received from the Middle East and North Africa. The balance of the crude consumed in East European refineries was supplied by the Soviet Union which accounted for approximately 70% of their total crude runs.

The dominance of East European petroleum supplies by the Soviet Union is economic as well as political. Presently, Soviet crude oil to East European countries costs an average $8.10 per barrel -- approximately

TABLE III-5

1975 EASTERN BLOC SUPPLY/DEMAND SUMMARY

(thousand barrels per day)

Country	1975 Total Demand	1975 Refinery Capacity	Refinery Outturns	Product Surplus/ Deficit	Refinery Input	Crude Production	Crude Surplus/ Deficit	Total Petroleum Surplus/Deficit	Estimated Stock Loss[a]	Total Petroleum Surplus/Deficit
Bulgaria	268	280	230	(38)	253	6	(247)	(285)	(11)	(296)
Czechoslovakia	230	405	303	61	329	4	(325)	(325)	(13)	(338)
East Germany	309	405	326	4	345	8	(337)	(337)	(13)	(350)
Hungary	185	223	194	1	211	38	(173)	(173)	(7)	(180)
Poland	256	316	245	(11)	267	8	(259)	(267)	(11)	(278)
Romania	228	497	362	120	393	265	(128)	(128)	(5)	(133)
Total Eastern Europe	1,476	2,126	1,660	137	1,798	329	(1,469)	(1,515)	(60)	(1,575)
Soviet Union	7,072	9,225	7,380	338	7,994	9,800	1,806	2,144	(86)	2,058
Total Eastern Bloc	8,518	11,351	9,040	475	9,792	10,129	337	629	(146)	483
Soviet Union % of Total Eastern Bloc	83%	81%	82%	71%	82%	97%	N/A	N/A	59%	N/A

N/A = Not Applicable.

[a]At 4% of throughput.

Source: Petroleum International Encyclopedia; Oil & Gas Journal; Arthur D. Little, Inc. estimates.

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two-thirds of the world parity price -- and does not require a hard currency payment. As the current long-term contracts start to expire, however, the Soviets are expected to gradually narrow this cost differential between their price and world market prices. This will provide further incentives for East European countries to diversify their sources of crude oil supply and by degrees lessen their dependence upon Soviet crude. Such a measure will allow the Soviet Union to continue to earn hard currency from crude exports and/or provide added leverage for petroleum technological importation through coproduction or exchange agreements for crude. Because of political considerations, it is highly improbable that the Soviet Union will completely shut off the supply of crude to its East European neighbors. It seems more likely that the current level of Soviet exports to Eastern Europe will be maintained, but that in Eastern Europe incremental demand growth for crude will have to be satisfied by increasing the level of imports from the Middle East.

From a variety of sources, a forecast of the supply and demand for petroleum in the Soviet Union was constructed (Table III-6).

TABLE III-6

SOVIET CRUDE OIL BALANCE

(million barrels per day)

	1975	1980	1985	2000	Annual Average Increase 1975 - 2000 (%)
Supply					
Production	9.4	11.5	12.7	15.8	2.1
Losses	(0.4)	(0.4)	(0.5)	(0.8)	--
Imports	0.1	0.2	0.2	0.1	--
TOTAL	9.1	11.3	12.4	15.1	2.0
Demand					
Consumption	6.9	9.5	10.3	13.0	2.6
Exports to:					
Eastern Bloc	1.3	1.0	1.0	1.0	--
Other	0.9	0.8	1.1	1.1	0.8
TOTAL	9.1	11.3	12.4	15.1	2.0
Net Soviet Exports	2.1	1.6	1.9	2.0	-0.2

Source: Arthur D. Little, Inc. estimates.

This estimate is somewhat more conservative than available long-range Soviet objectives and was based upon the following assumptions:

- The Soviet Union and East European countries are able to curtail petroleum demand to meet available supplies with much greater flexibility than free market countries. For example, only about 15% of the oil demand in the Soviet Union is consumed in the transportation sector where switching from petroleum fuel is relatively limited; in contrast, approximately 50% of the oil consumed in the United States is used for transportation. And a significant number of Soviet factories can be shifted from oil- to coal-fired boilers which would reduce petroleum demand for utility and industrial boiler fuels. Consequently, during the early and mid-1980's growth of domestic petroleum demand could be limited in order to offset crude oil production declines and to maintain a positive Soviet oil export position through the end of the century.

- For political motives, the Soviet Union will maintain a relatively constant level of exports to both Eastern Europe and other Communist countries such as Cuba and North Korea. However, the net price of Soviet crude to Communist countries will be almost equal to the world parity price by the early 1980's.

- Nuclear power generation will increase significantly in the 1990's. Thus, added nuclear power will help to dampen the growth rate for oil to levels much lower than those of the late 1960's and early 1970's when petroleum demand grew at an annual rate of 7% to 8%.

- Crude production and logistical problems will continue to plague the Soviet oil industry through the mid-1980's. However, the Soviet oil industry will acquire the necessary technology to exploit frontier regions of the Soviet Union by the year 2000. Furthermore, deep formation drilling and offshore drilling techniques will be developed and will lead to the uncovering of further proven reserves. It is assumed that a dozen additional oil fields similar to Samotlor, or the equivalent, will be developed in Siberia or in the Far East by the end of the century.

The key underlying assumption in bridging the petroleum technology gap in the Soviet Union is the recognition and eventual correction of organization and management problems in the Soviet petroleum industry. The Soviet Union must develop a totally integrated approach which is coordinated by a single high-powered agency such as the Committee for Science and Technology. The potential technical and logistical crude production problems predicted in the early 1980's could precipitate the necessary managerial reorganization. Such action has been proven successful in other high-priority programs of the Soviet Union such as the space program, nuclear weapons, nuclear power, the rapid build-up of the Soviet Navy, etc.

With the above assumptions the Soviet Union will enjoy a net oil export posture of approximately 2 million barrels per day in the year 2000. (See Table III-6.) The total internal demand for petroleum products in the Soviet Union in the year 2000 is expected to be approximately 13 million barrels per day (almost twice the 1975 demand) while production is projected to be almost 16 million barrels per day. Crude oil production at this time will be over 1.5 times the current annual level, over two-thirds of it coming from either the West Siberian or new oil frontier regions farther to the east. By 2000, the need for petroleum technological imports will most likely have decreased, which will reduce the pressure for oil exports to the West.

3. Import Dependence

Based upon an extrapolation of available planned refinery capacity expansions in Eastern Europe, crude runs there will grow at approximately 4% per year from 1975 to 2000. Indigenous East European crude production and Soviet oil exports to Eastern Europe are assumed to be relatively stable in absolute terms. Crude oil imports from outside Eastern Europe will need to increase at an annual average rate of 12% per year to a level of 3.8 million barrels per day by 2000. East European dependency upon imports of Soviet crude will then decrease from 93% in 1975 to less than 21% in 2000. (See Table III-7.) Thus, the oil self-sufficiency for the total Eastern Bloc will be reduced from 100% in 1975 to 86% by the end of the century and there will be a net import deficit of 2.8 million barrels per day (i.e., East European non-Soviet imports plus Soviet crude imports less Soviet exports to non-Eastern Europe, as shown in Table III-8).

TABLE III-7

PROJECTED EAST EUROPEAN CRUDE OIL REQUIREMENTS

(million barrels per day)

	1975	1985	2000	Average Annual Growth Rate 1975 - 2000 (%)
East European crude runs	1.8	4.1	5.2	4.3
East European domestic production	0.4	0.4	0.4	0.0
East European net crude imports required	1.4	3.7	4.8	5.1
Soviet crude imports	1.3	1.0	1.0	--
Other crude imports	0.1	2.7	3.8	15.7
Soviet crude as a per cent of total East European imports	93%	27%	21%	--

Source: Arthur D. Little, Inc. estimates.

TABLE III-8

EASTERN BLOC OIL IMPORT DEPENDENCE

(million barrels per day)

	1975	1985	2000	Average Annual Growth Rate 1975 - 2000 (%)	Source
Soviet exports to non-Eastern Europe	0.9	1.1	1.1	0.8	Table III-6
Less East European non-Soviet net imports	0.1	2.7	3.8	15.7	Table III-7
Less Soviet crude imports	0.1	0.2	0.1	--	Table III-6
Net Eastern Bloc surplus (deficit)	0.7	(1.8)	(2.8)	--	
Total estimated Eastern Bloc crude runs	10.6	14.2	20.3	2.6	
% Eastern Bloc self-sufficiency	100%	87%	86%	--	

Source: Arthur D. Little, Inc. estimates.

Recent estimates by the CIA project Eastern Bloc oil imports at 3.5-4.5 million barrels per day by 1985, based upon a continued decline of the reserve-to-production ratios resulting from technological and logistical crude production problems. Other Western intelligence agencies and industry sources are not nearly so pessimistic, believing that whatever moderate shortfall in supply may occur will be offset by reducing demand, thereby avoiding such high oil import levels and the resulting severe drain on their limited hard currency reserves. A significant amount of fuel substitution away from oil could be forced in these countries and the current relatively high losses could be reduced. However, regardless of the situation in the 1980's, we believe that net imports of approximately 2.8 million barrels per day will be required by the end of the century. Even if the pessimistic CIA projection proves true, this in itself would set in motion corrective reactions designed to reduce imports and increase frontier oil production to whatever extent is required.

This level of petroleum imports is equivalent to approximately four tanker receipts per day with average vessels of 100,000 dwt. It is expected that most of these crude imports will be shipped to the Baltic ports of Rostock, East Germany or Gdansk, Poland. However, approximately 300,000 barrels per day of crude from the Middle East could be fed to land-locked Hungary and Czechoslovakia via the Yugoslavian port of Rijeka.

As shown in Table III-9, Eastern Bloc crude oil imports from regions outside the Persian Gulf area and Iraq will be negligible in the year 2000. Most of the volume (80%) will be shipped in vary large crude carriers (VLCC's) from ports in the Persian Gulf around the Cape of Good Hope for either transshipment in Western Europe (e.g., Rotterdam) or lightered at sea before entering the Baltic. A small portion of Eastern Bloc Persian Gulf liftings (3% of imports) will be transported to the southern terminal of the Suez-Mediterranean (SUMED) pipeline and will be picked up by smaller tankers of about 100,000 dwt in Alexandria, Egypt. The remaining crude imports will be transported by a number of crude pipelines in the Middle East to the loading ports of Sidon and Tripoli in Lebanon; Banias, Syria; or Dortyol, Turkey. Almost all of the oil from these Mediterranean ports will be shipped in small tankers to Rijeka, Yugoslavia.

TABLE III-9

SHIPPING ROUTES FOR EASTERN BLOC CRUDE OIL IMPORTS IN 2000

Origin	Route	Imports (%)	Quantity (million tons)	Loading Ports	Discharge Ports
Persian Gulf	VLCC around Cape of Good Hope to transshipment terminals in Europe or lightered before entering the Baltic	80	112.0	Persian Gulf Ports	Rostock Gdansk
Persian Gulf	VLCC to SUMED pipeline to smaller tankers[a]	3	4.2	Alexandria, Egypt	Rijeka
Persian Gulf	Trans-Arabian pipeline to smaller tankers[a]	2	2.8	Sidon, Lebanon	Rijeka
Iraq	Pipeline to smaller tankers[a]	15	21.0	Dortyol, Turkey (Iskenderun Bay)	Rijeka
				Tripoli, Lebanon	Rijeka
				Banias, Syria	Rijeka

a. 100,000 dwt or less.

Source: Arthur D. Little, Inc. estimates.

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IV. AGRICULTURAL PRODUCTS

The various agricultural products, particularly grain and sugar, presently are the largest tonnage bulk commodities imported into the Soviet Union and Eastern Europe. While they are expected to lose their preeminent position as imports of oil into Eastern Europe become important, imports of agricultural products will continue to be the key to Soviet viability during periods of severely adverse weather conditions. During periods of normal weather conditions, imports of agricultural products[1] are expected to total 10 million tons per year by the end of this century. Soviet crop failures, which will continue to be a major factor, will result in increased imports of agricultural products to the extent that the availability of hard currency will permit.

A. AGRICULTURE IN THE EASTERN BLOC

The output of most agricultural products in the Eastern Bloc is dominated by the Soviet Union, as is evident from Table IV-1.

TABLE IV-1

PRODUCTION OF SELECTED AGRICULTURAL PRODUCTS IN THE EASTERN BLOC IN 1976

(million tons, except billion eggs)

	Wheat	Barley	Corn	All Grain	Potatoes	Sugar Beets	Milk	Eggs
Soviet Union	96.9	69.5	10.2	223.8	85.1	96.6	89.1	55.6
Bulgaria	3.1	1.8	3.0	8.1	0.4	2.3	1.8	1.9
Czechoslovakia	4.8	2.7	0.6	9.3	4.0	5.6	5.4	4.5
East Germany	2.9	2.7	0.0	8.0	6.4	4.9	8.1	5.0
Hungary	5.1	0.8	5.2	11.4	1.1	3.9	2.1	3.7
Poland	5.7	3.6	0.2	20.8	50.0	16.3	17.0	7.9
Romania	6.7	1.2	11.7	19.8	4.2	7.0	4.1	6.1

Source: U.S. Department of Agriculture.

Because of this dominance and the fact that traditionally the Soviet Union has supplied significant quantities of wheat and other agricultural products to Eastern Europe, what happens in the Soviet Union is the key to judging the outlook for imports of foreign agricultural products into the entire Eastern Bloc.

1. Excluding landings of fish and fish products (Section IV-K) and natural rubber (Section VI-B).

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The role of agriculture in the Eastern Bloc is more significant than it is in the United States and other industrialized Western nations. Farm output in the Soviet Union accounts for 20% of the Soviet GNP and employs 22% of the labor force. In Eastern Europe, farm workers account for 16% (Czechoslovakia) to 42% (Romania) of the total labor force while contributing 11% and 22% to the respective Gross National Products. In the United States, agriculture contributes just 3.25% of GNP and employs 4.6% of the labor force.

While the Soviet Union is very well endowed with most of the raw materials that it needs and covers by far the largest land area of any country in the world (twice the area of the 50 United States), growing enough food for its own population is a problem. (See Figure IV-1.)

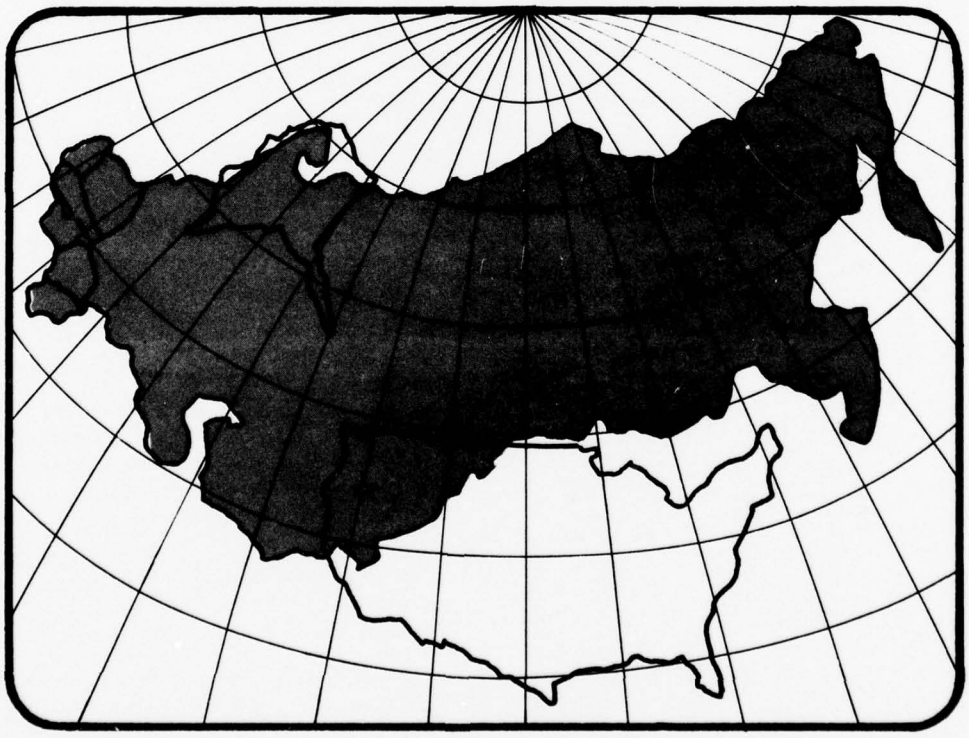

FIGURE IV–1 COMPARISON OF THE GEOGRAPHICAL LOCATION OF THE EASTERN BLOC AND THE UNITED STATES

As vast as the Soviet Union is, only a small percentage of the land is suitable for agriculture. Over 30% of the country is not suitable for agricultural crop production and another 40% is limited to hardy, early-maturing crops. In the traditional agricultural areas of European Russia, the climate is conducive to production of a variety of crops, but in the republics to the south, the lack of adequate rainfall again limits what can be grown.

In the West, the popular conception is that Soviet agriculture -- saddled with State control, Lysenko's disproved concepts, and all the attendant negative consequences these have created -- is inefficient, inadequate, non-progressive and misdirected. By some measures Soviet agriculture is as bad as its detractors make it out to be. For example, to feed 10% more people than are in the United States on a less varied diet, the Soviet Union requires five times as many farmers cultivating 50% more land -- and then it can succeed only in times of good weather. If the weather is unfavorable, large quantities of agricultural products must be imported, much of them from the United States.

It is easy, however, to overemphasize the negative aspects of Soviet agriculture, pointing out the lack of specialization, the low percentage of land left fallow,[2] and the lack of financial and psychological incentives for workers on state and collective farms. Nonetheless, in the past 25 years Soviet farm output has increased by 130% while inputs to agriculture have increased only by 75%, thus resulting in one-third more output than the equivalent amount of resources would have yielded in 1950.

Although average yields of various crops in the Soviet Union, with a few exceptions, are 10-50% less than U.S. yields, care must be taken in drawing conclusions from such comparisons because of the differences in the nature of the land planted in various crops in the two countries. Much of the land in the Soviet Union that is suitable for agriculture is similar climatically to the Northern Great Plains of the United States and the Prairie Provinces of Canada.[3] Many crops, however, are planted in regions of the Soviet Union that would not be considered suitable for that crop in the United States. For this reason, on average, Soviet land will continue to be less productive than that of the

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2. Fallow land is agricultural land that is not cultivated in a particular year so that moisture is conserved for the years that it is planted. Fallow farming is practiced in many of the wheat-growing areas of the North Central United States.

3. The Northern Great Plains includes North and South Dakota, Kansas, Nebraska, Montana and Wyoming, while the Canadian Prairie Provinces are Alberta, Saskatchewan and Manitoba.

United States. However, given the proper application of various production inputs on some Soviet soils, output per acre of some crops can reach and surpass U.S. levels. In the Soviet Union the yield of spring wheat is about half the yield in the United States. In contrast, Soviet winter wheat yields are equal to U.S. yields.

Relatively low labor productivity on Soviet farms cannot be blamed entirely on climatic conditions; there obviously are other reasons why ten Soviet farmers are required to produce what one U.S. farmer raises. Many of them can be traced to the collectivization of Soviet agriculture. Agriculture in the Soviet Union is divided into two sectors -- the socialized and the private. The socialized sector consists of state and collective farms and accounts for three-fourths of agricultural production; the private sector consists of small private farms and accounts for one-quarter of the output although they represent far less than one-quarter of the acreage planted. The basic reason lies in incentive. Collective farms are essentially producers' cooperatives and state farms are organized as state-operated agro-industrial enterprises. Their output does not belong directly to the farmer-workers who are raising the crops and there is minimal personal incentive to maximize yields. Incentives are far greater for the private plots that state and collective farmers and non-agricultural workers are permitted to cultivate (up to one-half acre and a few animals). Because the output of his small plot belongs to the farmer, he is strongly motivated to maximize its output. The result is a total output from these private plots much greater than their aggregate size would suggest, although it must be kept in mind that the nature of the crops grown on them (principally vegetables) also helps in this respect.

Losses also plague Soviet agriculture. Some losses can be attributed to weather, such as the unusually high rate of spoilage resulting from heavy rains during harvesting. Certainly, increased storage capacity and more drying facilities would help reduce farm losses. Again, these difficulties could be greatly minimized if the farmer-workers involved had more self-interest in the results. The average Soviet state farm involves the efforts of 570 individual farmers tilling 15,000 acres. The results achieved on that farm have much less direct impact on each of those individuals than the results achieved on the average 385-acre farm in the United States have on its three or four farmers. It is not even necessary to compare Western and Communist practices to discover such differences. Of the six countries in Eastern Europe, only Poland has not collectivized her farmers, and farm output in Poland has grown more rapidly than in any other Eastern Bloc country.

In an attempt to improve output, the farm sector in the Soviet Union has received disproportionate inputs of capital. Considering only direct investment during the 1971-75 five-year plan (i.e., none of the associated activities such as fertilizer production, construction of farm housing, etc.), agriculture received 20% of total Soviet investment compared to 5% in the United States. Still, results have been disappointing, in part because the continued rise in per capita income

and the government's promise of a higher standard of living have caused the demand for food to rise, thereby offsetting much of the gross gain made on the agricultural front.

Nevertheless, farm output in the Soviet Union and Eastern Europe has come a long way in the past 25 years. For the present study, we are concerned principally with the degree to which the progress that can be expected over the next 25 years will satisfy the internal demand for agricultural products. Consideration of the various factors involved in this judgment is facilitated by a basic understanding of the historical context within which agriculture has developed in the Soviet Union and Eastern Europe.

B. EASTERN BLOC AGRICULTURE IN HISTORICAL CONTEXT

From the time of the Revolution, the basic objectives of Soviet agriculture have been socialization of agricultural resources and the attainment of at least self-sufficiency in farm production. As might be expected, the attainment of full collectivization received greater emphasis than improvement of agricultural productivity, at least until very recently.

Although the formal decree that nationalized land in the Soviet Union came close on the heels of the Revolution, forcible collectivization of agriculture did not take place until Stalin was in power, more than ten years after the Revolution had succeeded. Initially, the idea was to support Stalin's goal of rapid industrialization of the Soviet Union with workers from the farms and capital generated by the sale of agricultural products at home and abroad. Expanded grain production became the principal target, but under forced collectivization grain production actually declined, livestock was slaughtered, and agriculture stagnated. Agriculture was expected to be a principal generator of capital, and therefore very limited capital was provided to it. In fact, this became one of the major impediments to increased agricultural output in the early years.

At the time of his death in 1953, Stalin could not claim Soviet agriculture had achieved very many gains for the Soviet worker. Total grain production was still below the 1913 level, as was the number of cattle and horses. But Stalin had socialized the system to a high degree, the number of hogs and sheep had increased, some Soviet-made agricultural equipment had become available, food prices were low, and some farm workers had taken up jobs in industry.

With Stalin gone, Khrushchev came to power. His answer to the Soviet agricultural problem was to expand the area under cultivation. Under his Virgin Lands program, new farming areas were developed eastward into Siberia and southward into Kazakhstan. During the next ten years, land under cultivation increased 35%, from 390 million acres in 1953 to 525 million acres in 1964. Khrushchev also pushed for the planting

of higher-yielding grains, increased the use of fertilizer, raised agricultural prices and farm wages, and emphasized higher farm investment. However, many of these measures were adopted prematurely as a reaction against Stalin's previous policies and non-results. Although they did get Soviet agriculture off dead center, they also made output more vulnerable to variations in the weather and created conditions under which a counter reaction was inevitable.

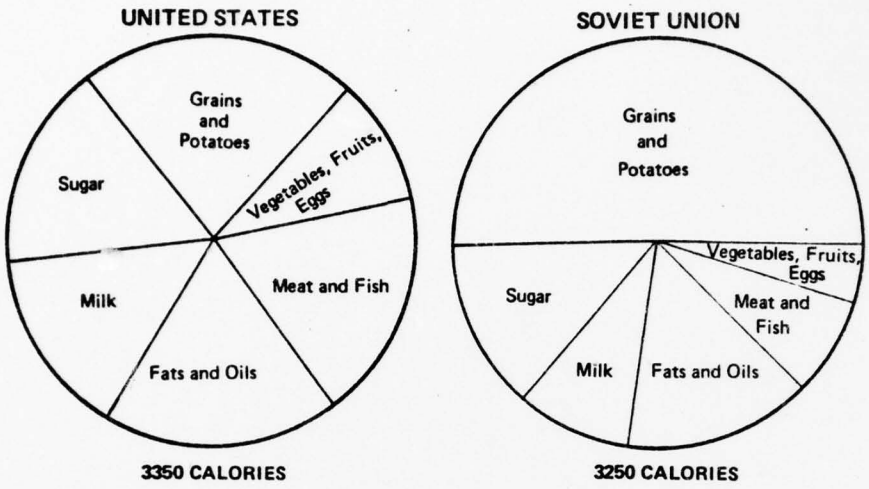
After the drought of 1963, which was one of the events that brought about Khruschev's downfall, it fell to Brezhnev, his successor, to formulate Soviet agricultural policy around more realistic long-term objectives. Brezhnev's first decision was to announce that private farm plots would be encouraged. Since such private plots occupy only 3% of the country's sown area, but produce over 25% of the total volume of Soviet farm output, this decision was eminently pragmatic, although obviously at odds with the philosophy of full collectivism. In addition, capital investment in agriculture increased dramatically, fertilizer use doubled in eight years, and increased incentives were provided to farmers in the form of higher farm prices, a 50% price premium for sales of some commodities above set government procurement levels, and inclusion of farmers in the Soviet pension system. The most unproductive areas that had been opened up under Khrushchev's Virgin Lands program were abandoned, reducing the total area under cultivation.

Since the mid-1960's, Soviet agriculture has progressed quite steadily and apparently to the satisfaction of those who matter most. The devastating crop failures of 1972 and 1975 did not topple the government as previously would have been the case. Someone still had to be blamed, but in both cases, it was limited to the Minister of Agriculture and the penalties were not extreme -- the Minister ousted for the 1972 crop failure became Ambassador to Czechoslovakia; the one removed after the 1975 failure was made Ambassador to Japan.

After World War II, when Eastern Europe came under Communist domination, collectivization of agriculture was given the highest priority; only Poland ultimately resisted the trend. The results, although mixed, have not been particularly encouraging, but there is little indication that any of the East European governments involved will reverse their attitudes in this regard.

C. FUTURE GOALS AND PLANS

On average, the 350 million inhabitants of the Soviet Union and Eastern Europe consume just about the same number of calories per capita as people in the more advanced countries of Western Europe and the United States. What they eat, however, is quite different, with Westerners obtaining twice as many of their calories in the form of meat and other high-valued foods and one-half as many in the form of bread and potatoes. (See next page for the composition of Soviet and U.S. diets in 1973.)



Soviet nutritionists recommend a diet more in line with that of the West, including more meat, fruits and vegetables and less potatoes and grain products. The recommended per capita "consumption norms" have been adopted by the Soviet leadership as part of their drive toward a higher standard of living for the Soviet people. Table IV-2 presents these consumption norms and the actual consumption levels since 1950 and planned for 1980. Despite the regulated stability of consumer food prices -- there has been no change in the retail price of most food commodities since 1960 -- such a change in dietary habits must be supported by increasing income levels and this too the leadership has promised.

In the next 25 years many, but decidely not all, of these consumption norms probably can be achieved. Table IV-3 compares the average annual growth in consumption of selected food products in the Soviet Union for 1960-1970 and 1970-1976 with the growth rates that will have to be achieved during the period 1976-2000 to realize the consumption norms recommended by the Institute of Nutrition of the Soviet Academy of Sciences. These data take into account the fact that the Soviet population will have increased by 22% between 1976 and 2000, requiring that the food supply increase at an average rate of 0.8% per year just to stay even.

In two products -- fish and sugar -- the norm has already been reached so future increases must simply match growth in population. The requirements for potatoes and grain actually drop, making more available for other uses or freeing up the land for other crops. However, per capita consumption of these products can be reduced only if their place is taken by other products such as meat, fruits and vegetables.

The norms for milk, eggs and vegetable oil seem to be achievable. The growth of 2.6% per year in meat consumption, although below the growth rate actually achieved since 1960, is in doubt, and the growth rates

TABLE IV-2

PER CAPITA CONSUMPTION OF SELECTED FOOD PRODUCTS IN THE SOVIET UNION

(kilograms per year except eggs which are number per year)

Food	Consumption Norm[a]	Consumption					Achievement Rate (% of Norm)	
		1950	1960	1970	1976	1980 Plan	1976	1980 Plan
Meat and fat	82	26	40	48	54	60	66	73
Fish and fish products	18.6	7.0	9.9	15.4	18.5	NA	99	NA
Milk and dairy products[b]	405	172	240	307	315	330	78	81
Eggs	292	60	118	159	214	225	73	77
Sugar	40.0	11.6	28.0	38.8	41.0	43	103	108
Vegetable oil	9.1	2.7	5.3	6.8	8.0	NA	88	NA
Potatoes	97	241	143	130	120	115	124	119
Grain (flour equivalent)	110	172	164	149	145	140	132	127
Vegetables and melons	146	51	70	82	87	113	60	77
Fruits and berries	113	11	22	35	37	50	33	44
TOTAL[c]	1,040	700	730	820	840	890	81	86

NA = Not available

a. Recommended by Institute of Nutrition, Academy of Sciences, USSR.

b. Including milk equivalent of butter and cheese.

c. Eggs included at 55 grams per egg and data not available for 1980 included at nominal increase over 1976. Total rounded to nearest 10.

Source: Based on U.S. Department of Agriculture data.

Arthur D Little Inc

TABLE IV-3

AVERAGE ANNUAL GROWTH IN TOTAL CONSUMPION
OF SELECTED FOOD PRODUCTS IN THE SOVIET UNION

(% per year)

	Actual Rate of Growth 1960-1970	Actual Rate of Growth 1970-1976	Rate of Growth Required to Achieve Consumption Norm 1976-2000
Meat and Fat	3.14	2.93	2.58
Fish and Fish Products	5.82	4.05	.84
Milk and Milk Products	3.79	1.38	1.87
Eggs	4.33	6.03	2.12
Sugar	4.62	1.87	.72
Vegetable Oil	3.82	3.70	1.36
Potatoes	.35	- .42	- .06
Grain (flour equivalent)	.35	.50	- .32
Vegetables and Melons	2.89	1.94	3.00
Fruits and Berries	6.05	1.88	5.58

Source: Based on U.S. Department of Agriculture data.

that would have to be realized in vegetables (3.0% per year) and particularly in fruits and berries (5.6% per year) will be very difficult to achieve even by 2000.

The measures being taken to reach these goals include application of ever-increasing quantities of fertilizer, development of new plant varieties, development of very large cattle farms and various land improvement programs. One of the most widely publicized opportunities for improving Soviet agriculture is being undertaken in the Non-Black Soil Zone. In this area, which covers much of the northern part of European Russia, the climate is favorable but the natural soil conditions are well below optimum and large-scale land improvements (mostly drainage and liming) are required to maximize its agricultural output. Nevertheless, the Zone, which has a population of 58 million people and includes 130 million acres of agricultural land (9% of total Soviet agricultural land) and 80 million acres of arable land (14% of the total arable land), already is a significant factor in Soviet agricultural production. It accounts for 35% of the rye, 25% of the oats, 40% of the flax, 30% of the potatoes, 20% of the vegetables, 15% of the meat, and 20% of the milk and eggs produced in the Soviet Union today.

Development of the Non-Black Soil Zone is planned to take place over the next 15 years. Almost 25 million acres will be drained, more than 5 million acres will be irrigated for pasture land and to grow vegetables around urban centers, and 55 million acres of acid soil will be limed. The expected results of this effort, which includes an investment of 43 billion rubles, will be major increases in the Zone's production of grain (a 67% increase in 1980 compared to 1973), meat (a 38% increase), milk (27%) and eggs (37%).

The application of fertilizer has advanced rapidly in the Soviet Union although admittedly from a very low base. Fertilizer deliveries rose 69% from 1965 to 1970 and 64% from 1970 to 1975, at which time application rates were about one-half of the U.S. application rate. The target for 1980 calls for another 60% increase.

While recent five-year plans continually have called for increases in newly irrigated and newly drained agricultural land, for the long term the massive project to divert several Siberian rivers for irrigation purposes is perhaps more important. In this project, water from the Ob, Irtysh and Yenisey rivers, which flow north, would be diverted to the south through Kazakhstan to the Caspian Sea and, in their new courses, would be used to irrigate 25 million acres of land that now is on the borderline of being desert. Another major project calls for the irrigation of 20 million acres in the Volga Valley. Nationwide, it has been proposed to bring irrigated land up to 52 million acres and drained land up to 67 million acres by 1985. In the longer term, proposals call for 75 million acres to be irrigated and 125 million acres drained.

The Soviet Union and Eastern Europe are in the midst of what could eventually result in some major changes in basic agricultural policy.

The problem focuses around the inconsistency between fixed, heavily subsidized food prices and the increasing demand for certain foods, such as meat, which accompanies a rise in per capita disposable income. In Hungary, for example, consumers pay 45 forints[4] for a kilogram of pork which costs 60 forints to produce. In East Germany, consumers pay 23% lower food prices than they would without subsidies. With shortages as the equalizing market force rather than higher market prices, something eventually must give.

If the ultimate choice is made in favor of higher prices, at least one aspect of Soviet agricultural organization could be improved -- the dichotomy between government procurement costs and retail purchase prices. In an attempt to induce workers on collective farms to provide more days of participation as well as a higher quality of labor, prices paid to farms have risen by 75% since 1960. Since retail food prices have been held constant, food is becoming more highly subsidized as time passes. For example, the average government procurement cost for cattle and hogs is nearly three times the average prices paid to U.S. farmers (assuming 1974 prices and the official exchange rate).

The policy of maintaining stable retail food prices, coupled with the wide fluctuations in domestic agricultural output, has meant that periodically the Soviet Union has had to depend on extraordinary imports of agricultural goods to satisfy the normal demand. One of the stabilizing influences in Soviet agriculture has been the private farm plot where farming practices are more akin to Western practices than are the practices on state and collective farms because the output belongs to the farmer. For example, if adverse conditions are encountered, the state or collective farmer has a tendency to sit back and blame the cause, while the farmer with a private plot will do whatever he can to maximize its output regardless of the conditions. Because of official policies, however, production from the private sector in recent years actually has fluctuated more than that from the state and collective farms. This situation apparently is due to the failure of the authorities to allow the private sector the quantity and quality of input materials such as fertilizer which it needs to operate effectively. As a result, private farms no longer enjoy as great a yield advantage as they once did.

In most of the East European countries, the immediate concern in agriculture is to emphasize the production of crops, particularly grain, and slow down the growth in livestock production. This is a recent basic policy change caused by a combination of the current difficulties of exporting meat to the members of the European Economic Community and the reduction in regular Soviet grain exports to Eastern Europe in

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4. The official exchange rate is 8.5 forints per dollar while the unofficial rate is 20.8 forints per dollar, but neither accurately reflects the cost of such a product.

recent years because of crop failures. Each East European country is aiming at self-sufficiency in those agricultural products for which it is climatically suited. Fertilizer use in Eastern Europe generally is high already, but will continue to increase. (See Figure IV-2.) In Czechoslovakia and East Germany, where there is an acute shortage of labor, emphasis is being put on the mechanization of the agricultural sector. Throughout the region, as in the Soviet Union, land is being drained or irrigated, product specialization is being promoted, and various other steps to higher productivity are under way.

In the sections below we examine several of the more important agricultural products in some detail.

D. LIVESTOCK AND POULTRY PRODUCTS

The principal livestock and poultry products in the Eastern Bloc are beef, veal, mutton, lamb, pork and poultry (which together make up "meat"), milk, butter, cheese and eggs.

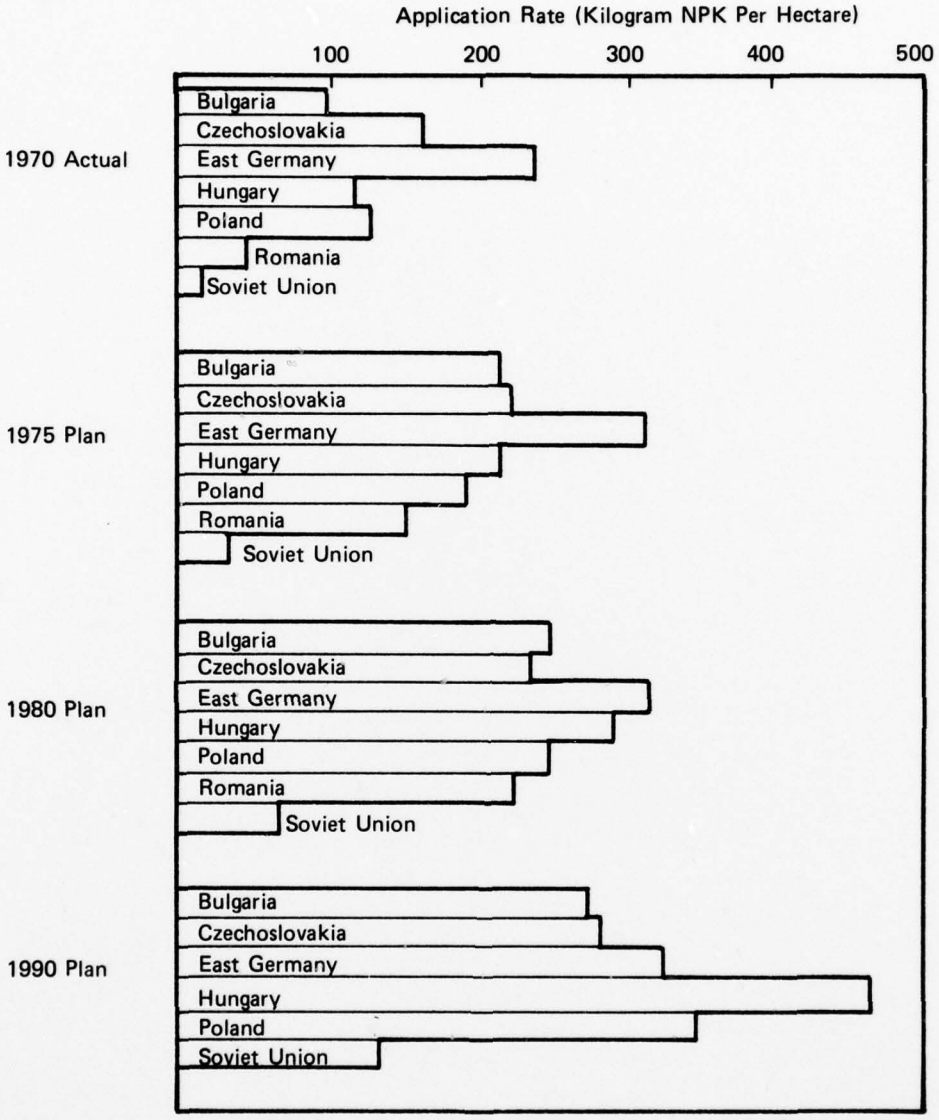
Until recently, government policies in the entire Eastern Bloc were aimed at bringing the dietary caloric level up to the standard of the economically advanced nations of the West. Now the diets of people in the Eastern Bloc average 3,000 to 3,250 calories per day with 76 to 93 grams of protein, which is generally comparable to those in many Western countries. Having succeeded in this, and with the rising per capita incomes of recent years, the current emphasis is on improving diet quality. As a result, there has been an attempt to shift from high carbohydrate foods (e.g., grains) to high protein foods, principally livestock products.

1. Meat

The quality of the diets differs considerably between the northern and southern countries of Eastern Europe. In Czechoslovakia, East Germany and Poland, meat accounts for about 50% of total protein intake while in Bulgaria and Romania, meat provides only 30% of the protein requirements. The consumption of meat in Hungary and the Soviet Union falls between these extremes. Generally, per capita meat consumption in Eastern Europe is slightly lower than in Western Europe if comparisons are made between countries with similar per capita incomes.

However, there is a major difference in the quality of the meat in the Eastern Bloc and the West. Meat available for domestic consumption in the Eastern Bloc often has a large percentage of fat, bones and waste, and generally is of poorer quality[5] than meat available in advanced West European countries or the United States. Of course, this is not the

5. Generally, meat and poultry products are from older, more mature animals.



Source: Phosphorus & Potassium, May/June 1975.

FIGURE IV–2 EASTERN BLOCK FERTILIZER APPLICATION RATES

case with meat that is exported from countries such as Poland to the West. Pork is the mainstay of meat consumption in all East European countries in spite of the fact that pork is more expensive than beef in all countries except East Germany. In Poland pork accounts for two-thirds of total meat consumption but even in Bulgaria, the only country in which mutton and lamb constitute a major portion of total meat consumption, pork consumption is 30% higher than that of beef and 50% higher than that of mutton and lamb. The consumption pattern in the Soviet Union is the reverse; beef accounts for a little over 50% of total meat consumption and pork about 30%.

In recent years, consumption of almost all meat products has increased significantly in each country, although there are major differences in the consumption pattern of these products in various countries, as is evident from the data of Table IV-4. Meat consumption is considered the bellwether of the trend toward a higher standard of living. While he consumes about the same number of calories each day, the average Soviet citizen eats only 40% as much meat as his U.S. counterpart and, in fact, consumes significantly less meat than many of his East European counterparts. Part of this deficiency is made up by the high consumption of fish -- twice the per capita level of the United States -- but still, the increased availability of meat typically is regarded as the principal indicator of the leadership's success on this front.

In an attempt to examine the outlook for the future demand for livestock and poultry products in the various countries of the Eastern Bloc, the Food and Agricultural Organization of the United Nations and the United States Department of Agriculture analyzed how per capita consumption of livestock and poultry products had changed as the level of income changed (i.e., the income elasticity of these products).

Considering the projected per capita income levels in these countries and the income elasticities of the various meats and other livestock and poultry products, it is evident that consumption of these products will increase significantly as long as they are made available. In the Soviet Union an average growth rate of 2.6% per year will be required to achieve the current annual consumption norm of 82 kilograms of meat and fat by the year 2000. This growth rate is well below the 3.1% per year achieved in the 1960-70 period and 2.9% per year realized between 1970 and 1976. Consumption in Czechoslovakia and East Germany is already nearly at the Soviet consumption norm, while Poland, Bulgaria and Hungary are about on a par with the Soviet Union. Only Romania, with current annual meat consumption of 37 kilograms per person, is lagging badly in this respect.

The income elasticities for meat generally are highest in those countries with low per capita income levels, whether they are in the Eastern Bloc or in Western Europe. In all instances, the income elasticity of beef is at least equal to, and in most cases well above, the income elasticity of pork, which means that demand for beef will increase faster than demand for pork.

TABLE IV-4

ANNUAL PER CAPITA CONSUMPTION OF
SELECTED LIVESTOCK PRODUCTS FOR FOOD -- 1966-1970 AVERAGE

(kilograms)

	Total Meat[a]	Beef	Mutton & Lamb	Pork	Poultry	Milk	Eggs
Soviet Union	44.0	21.2	5.1	13.3	4.4	307.0[b]	8.7
Bulgaria	38.3	10.4	8.9	13.9	5.1	112.5	7.6
Czechoslovakia	60.8	20.8	0.8	33.6	5.6	115.8	13.6
East Germany	63.0	18.8	1.3	38.4	4.6	101.0	12.3
Hungary	50.2	9.3	0.9	27.8	12.2	106.6	11.5
Romania	28.9	8.0	2.8	12.9	5.1	112.1	5.2
Poland	48.1	14.3	0.7	30.0	3.1	253.2[b]	9.7
West Germany	67.9	23.0	0.2	37.3	7.4	74.8	15.2
France	69.9	28.3	2.7	25.4	13.5	105.6	12.6
Italy	41.0	21.8	0.8	9.1	9.3	66.3	9.4

a. Total may not equal sum of individual meat products because of rounding.

b. Presumably includes milk used for animal feed.

Source: U.S. Department of Agriculture.

Czechoslovakia is the only country in Eastern Europe that is a net importer of meat, being 95% self-sufficient. Although in theory the Soviet Union could import meat to cover domestic shortages, as a practical matter, the vast bulk will be raised domestically and consumption will be forced to match whatever production level is achieved. Soviet imports of meat in the past have been quite limited except in 1974 and 1975 when 700,000 to 800,000 tons were imported. Imports of meat in 1974 were due to the crop failure which drastically reduced animal feed availability while the imports in 1975 were related more to the Soviet Union acting as the alternative market for East European livestock products that normally would have been exported to Western Europe if restrictions on such imports had not been imposed by the European Economic Community. In other years total Soviet meat imports averaged about 200,000 tons, or somewhat over 1% of the total domestic livestock slaughter of 15 million tons carcass weight. In fact, in no case is trade among the various members of the Eastern Bloc a major factor in the supply of meat products.

While meat production is receiving much attention, with most Western authorities not expecting goals set for the next few years to be met, we believe that by the end of the century the Eastern Bloc still will be essentially self-sufficient in meat production. The most critical factor in reaching the goals will be the increasing efficiency of feed grain production, which is discussed in a subsequent section. By the year 2000, the importation of meat into the Eastern Bloc during normal crop years probably will be around 300,000 tons, most of which will come from the east coast of South America and Australia. The imports will be principally into the Soviet Union via the Black Sea while 20% may go into the Baltic and 10% to the Pacific Coast.

2. Milk and Dairy Products

To reach the consumption norm by 2000, Soviet milk consumption (including the milk equivalent of butter and cheese) must increase at about 1.9% per year, well below the rate achieved from 1960 through 1970, but somewhat above the rate of increase between 1970 and 1976. Milk consumption is growing only 20-30% as fast as income (i.e., the income elasticity for most countries lies between 0.2 and 0.3). Considerable quantities of milk products are utilized as animal feed in the Soviet Union and Poland.

It is reasonable to assume that the Eastern Bloc will be self-sufficient in milk in the year 2000 and that imports, if any, will come principally from Finland with some also received from Western Europe. Production of butter also should be adequate, with minor imports from Western Europe.

3. Eggs

The pattern of egg consumption in the Eastern Bloc is very similar to that for meat consumption, with the population in Czechoslovakia and East Germany consuming as many eggs as West Germans and the French,

while those in the south (Bulgaria and Romania) consume only about half as many. In Hungary, Poland and the Soviet Union, egg consumption is between these extremes.

Egg production has been one of the brighter areas of Soviet agriculture with a general upward trend not affected to a major degree by variations in the weather and often coming in above plan. For example, even after the tight feed situation in 1975 forced heavy culling of layers, production in 1976 fell only 4% below the record 1975 production of 58 billion eggs.

To achieve the Soviet egg consumption norm by 2000, availability must increase at just over 2% per year. Considering that consumption has increased at over twice this rate during the past 15 years, this goal seems to be within reach well before the end of the century.

In spite of rapidly increased domestic output, Soviet egg imports have remained relatively high -- an average of 850 million (50,000 tons) for the 1971-75 period. However, few, if any, of these are waterborne shipments since they come principally from Poland, Finland, Hungary and Bulgaria. Net imports (i.e., from Finland) into Eastern Europe are only around 15,000 tons and do not involve ocean transportation.

E. GRAIN AND ANIMAL FEED

The importation of grain and animal feed after recent Soviet crop failures has been the most visible and widely publicized trade between the West and the Eastern Bloc. In 1973 Soviet imports alone reached 24 million tons, almost two-thirds of it originating from the United States. While in Western terms large imports of grain and animal feeds might be more economic than developing comparable domestic production, limitations on hard currency availability dictate a more or less balanced production of livestock and animal feed. Consequently, we believe ocean-borne imports of grains, oilseeds and oilseed meals into the Eastern Bloc will average around 5 million tons per year during years of normal weather.

The Eastern Bloc produces more than enough grain to feed the population. Even with the disastrous harvest of 1975, food requirements in the Soviet Union accounted for just 43% of Soviet grain production. However, when combined with all the other grain uses, the grain balance becomes the leading indicator of Soviet agricultural performance.

Of the total of something over 200 million tons of grain available in recent years in the Soviet Union, seed grain for the following year requires about 25 million tons (12.5%) while industrial uses such as for the production of alcohol, beer, starch and syrup requires another 3 million tons (1.5%). Soviet grain exports, principally to Eastern Europe, generally total around 6 million tons (3%) while domestic food requirements total about 60 million tons (30%). The remainder of over 100 million tons (53%) is used for animal feed. Table IV-5 shows how the composition of Soviet grain production has changed since 1960.

TABLE IV-5

DISTRIBUTION OF SOVIET GRAIN PRODUCTION[a]

	1960		1965		1970		1975		1976	
	(MM tons)	(%)	(MM tons)	(%)	(MM tons)	(%)	(MM tons)	(%)	(MM tons)	(%)
Spring wheat	46.1	36.5	27.9	22.9	57.5	30.7	29.6	21.1	52.4	23.4
Winter wheat	18.2	14.6	31.9	26.3	42.2	22.6	36.7	26.2	44.5	19.9
Barley	16.0	12.7	20.3	16.8	38.2	20.4	35.9	25.6	69.4	31.0
Rye	16.4	13.1	16.2	13.4	13.0	7.0	9.1	6.5	13.9	6.2
Corn	9.8	7.8	8.0	6.6	9.4	5.0	7.3	5.2	10.1	4.5
Oats	12.0	9.6	6.2	5.1	14.2	7.6	12.5	8.9	18.1	8.1
Millet	3.2	2.5	2.2	1.8	2.1	1.1				
Pulses	2.7	2.2	6.7	5.5	7.6	4.1				
Buckwheat	0.6	0.5	1.0	0.8	1.1	0.6	9.2	6.6	15.2	6.8
Rice	0.2	0.2	0.6	0.5	1.3	0.7				
Other	0.3	0.2	0.2	0.2	0.2	0.1				
TOTAL	125.6	100.0	121.1	100.0	186.8	100.0	140.1	100.0	223.8	100.0

a. Production is reported in terms of the weight of harvested grain as it comes from the combine and does not take into account potential losses due to excess moisture, dirt, weeds and other extraneous matter. Such losses often are assumed to be 10%, but are variable depending on the weather encountered and the crop itself. The figures also include grain that will be lost in handling.

At 110 kilograms per year, the Soviet per capita consumption norm for grain is well below the current consumption level of 145 kilograms. The total grain available for food can fall at a rate of 0.32% per year and still meet the consumption norm in 2000, thereby providing almost 4 million tons of grain for the fastest growing use for grain -- animal feed.

Traditionally, livestock herds were only a residual claimant on the Soviet grain supply. In the early 1960's, for example, livestock feed consumed about one-third of the total grain available, or a little over 40 million tons, and the amount was reduced whenever a poor harvest was encountered. Starting in the mid-1960's, however, the availability of grain for animal feed has grown rapidly to support the expanding livestock herds and poultry flocks with increasing amounts of grain per animal.

Since 1970 animal feed has consumed over one-half of all domestically-consumed grain in the Soviet Union. No longer is animal feed a residual category; in recent years priorities have changed and now the Soviets import grain rather than cut back on animals or reduce rations. Only in 1975, when imports of 16 million tons of grain were insufficient to offset the poor harvest, were herd and flock sizes reduced. Even then, the real reduction was in animal weight; animal populations were reduced only marginally.

Crop failure in the Soviet Union no longer means necessarily starving people; it will mean starving cattle and probably broken agreements with East European countries in order to supply their own grain needs.

Paradoxically, a poor crop year does not necessarily mean an immediate reduction in the amount of meat in the stores because, without feed, slaughter rates tend to increase although the cattle that are slaughtered tend to be underweight. It is in the ensuing years, when the decimated herds (and to a lesser degree the flocks) are being rebuilt, that consumer shortages appear.

Assuming continuation of current trends in the production of vegetable protein and energy sources for animal feeds, there will be insufficient supply of animal feed ingredients to produce a livestock and poultry industry to support the expected increase in meat demand in the Soviet Union. Up to now, the response to these deficits has been to rely on foreign imports for some of the animal feed required. In fact, around 5 million tons of feedgrains recently have been imported each year into the Soviet Union and 3 million tons into Eastern Europe. However, expansion of this trade commensurate with meat demand is not a logical long-term solution. Instead, both domestic crop production and animal feeding efficiency must be improved. The penalties for failure are shortages and/or some form of rationing (which could include raising meat prices).

One of the programs specifically aimed at producing animal feed and improving livestock and poultry is the development of the Non-Black Soil Zone. A fundamental part of the program is to introduce large-scale, specialized complexes for production of milk, pork and poultry. And throughout the Soviet Union the downward trend in acreage planted in grains has been reversed, fertilizer deliveries to agriculture are being increased, massive irrigation systems are planned and new plant varieties are being developed.

The area seeded to grain in the Soviet Union declined throughout the 1960's and early 1970's. In 1973, possibly spurred on by the crop failure of the previous year, this trend was reversed and there was an increase of 20 million acres seeded to grain. In view of the declining demand for grain to fulfill direct food requirements, any increase will be used for livestock and poultry production.

As seeding practices are improved, it is likely that the amount of seed grain required per acre can be reduced considerably. Almost 20% of the grain crop was set aside for seed in the early 1960's. A decade later less than 15% was set aside, but this was still about twice the seeding rate employed in the United States and Canada. If this decline continues, the Soviet seeding rate may reach the level of current U.S. practice by the end of this century, releasing additional grain for use as animal feed. Of course, the increased application of fertilizer and other technical improvements such as the planned massive irrigation projects will contribute to increased production of grain as well as other agricultural products.

Efforts to satisfy the growing protein needs of the livestock and poultry sectors are not as far advanced as the efforts to satisfy the energy requirements. Although high-protein oilseeds and pulses are under development, and production of dehydrated grass and legume meals, fish meal and synthetic feed yeasts is expanding, the potential for increasing the area planted in oilseeds is limited, and to date moves such as a major increase in the acreage planted in high-protein crops or the possibility of planting mixed corn and soybeans to increase silage protein levels are merely suggestions from the scientific community. Thus, while the energy requirements of animal feeds for the livestock industry are projected to be satisfied from domestic sources some time during the late 1980's, it may well be another decade before the protein content of these feeds has reached the required level.

The most important shortcoming of the Soviet cattle feed industry is not so much a shortage of good feed as inadequate processing and distribution. The short Soviet growing season makes early harvesting imperative, resulting in a product with reduced nutritive value that cannot be shipped the long distances to where it is required. To help solve this problem, the Soviets recently initiated efforts to combine various grains, urea and bentonite into an animal feed that can contain up to 85% protein equivalent for ruminant animals. In the future an even more complete solution could come from manure recycling. The protein produced by the recycling process is equivalent to that found in soybeans, but it can be produced at a lower cost. If the manure produced by one-half of the Soviet cattle population were processed by this method, the protein produced would equal that of the total U.S. soybean crop.

Soviet planners apparently are having difficulty developing consistent plans for the animal feed, livestock and poultry sectors of the economy. In the 1971-75 five-year plan, the substantial growth targeted for livestock and poultry production was not supported by sufficient planned growth in animal feed output. And, while the 1976-80 plan calls for a balance between feed and animal output, targeted production levels appear to be significantly below what demand will be if disposable income increases as planned. This suggests the possibility that the prices of livestock and poultry products may be increased. As noted earlier, the other method of balancing supply and demand -- major imports of meat -- seems likely only under unusual circumstances such as after herds have been thinned as a result of a crop failure. Of course, if the price subsidy for meat is eliminated or greatly reduced, then meat imports could be utilized effectively at any time. In the final analysis, the maximum Soviet imports of grains and oilseeds will be influenced as much by the cost of these commodities in terms of hard currency as it will by the supply-demand balance in the Eastern Bloc.

Until the various land improvement projects can be brought to full fruition, imports of high-protein feed materials such as soybeans and other oilseeds and/or oilseed meals may well rise substantially above the

level of recent years -- assuming hard currency or its equivalent is available for such purposes. However, it appears most reasonable to expect the Soviets to be successful in meeting the bulk of their protein feed requirements by 2000 while also gaining somewhat better control over the year-to-year fluctuations that have plagued the Soviet Union for so long.

One reason for this optimism is the gains that were achieved in agriculture throughout the Eastern Bloc during the last 25 years. Others include the opportunity to reduce the acreage sown in grain and replace it with oilseed crops, the land improvement programs, and the political imperatives of the agricultural sector. On the other hand, as discussed in Section IV-I, if the climatologists are correct, swings in the weather could become even more extreme than in recent years and the Soviet goal of a year's supply of grain and oilseeds in storage, which would require approximately double the present storage capacity, may become a necessity rather than just a desirable goal in the not-too-distant future.

If our optimism proves misplaced, we believe the availability of livestock and poultry products will be reduced to match whatever is produced; sufficient hard currency will not be available to fill any substantial regular shortfall in basic feed requirements with imports. As they have been for years, major imports of protein and energy feed products will be required principally during periods of adverse weather rather than to cover a basic feed deficit. For purposes of this study, we have assumed nominal ocean-borne imports of grains, oilseeds and oilseed meals into the Eastern Bloc of 5 million tons at the end of this century, somewhat below the level of imports justified in recent years during periods of normal weather. The sources and destinations of such imports will be determined by grain purchase agreements, the location of yet-to-be constructed grain storage facilities, the distribution of Soviet population, etc.

Soviet port capacity is not considered a limiting factor since it is estimated that, if necessary, Soviet ports could handle as much as 36 million tons of grain imports during a 12-month period. In 1975, deliveries of grain from the United States to the Soviet Union totaled 7.2 million tons, of which Black Sea ports handled 70% (5.0 million tons), Baltic ports 18%, and Far Eastern ports 12%.

We have assumed that at the end of this century 500,000 tons of grain will be shipped annually to the Pacific Coast, 2 million tons will go to the Black Sea and 2.5 million tons will go to the Baltic Sea, broken down by source as follows (in millions of tons):

	Black Sea	Baltic Sea	Pacific Coast
North America	2.5	1.4	-
South America	.5	-	-
Australia	-	-	.5

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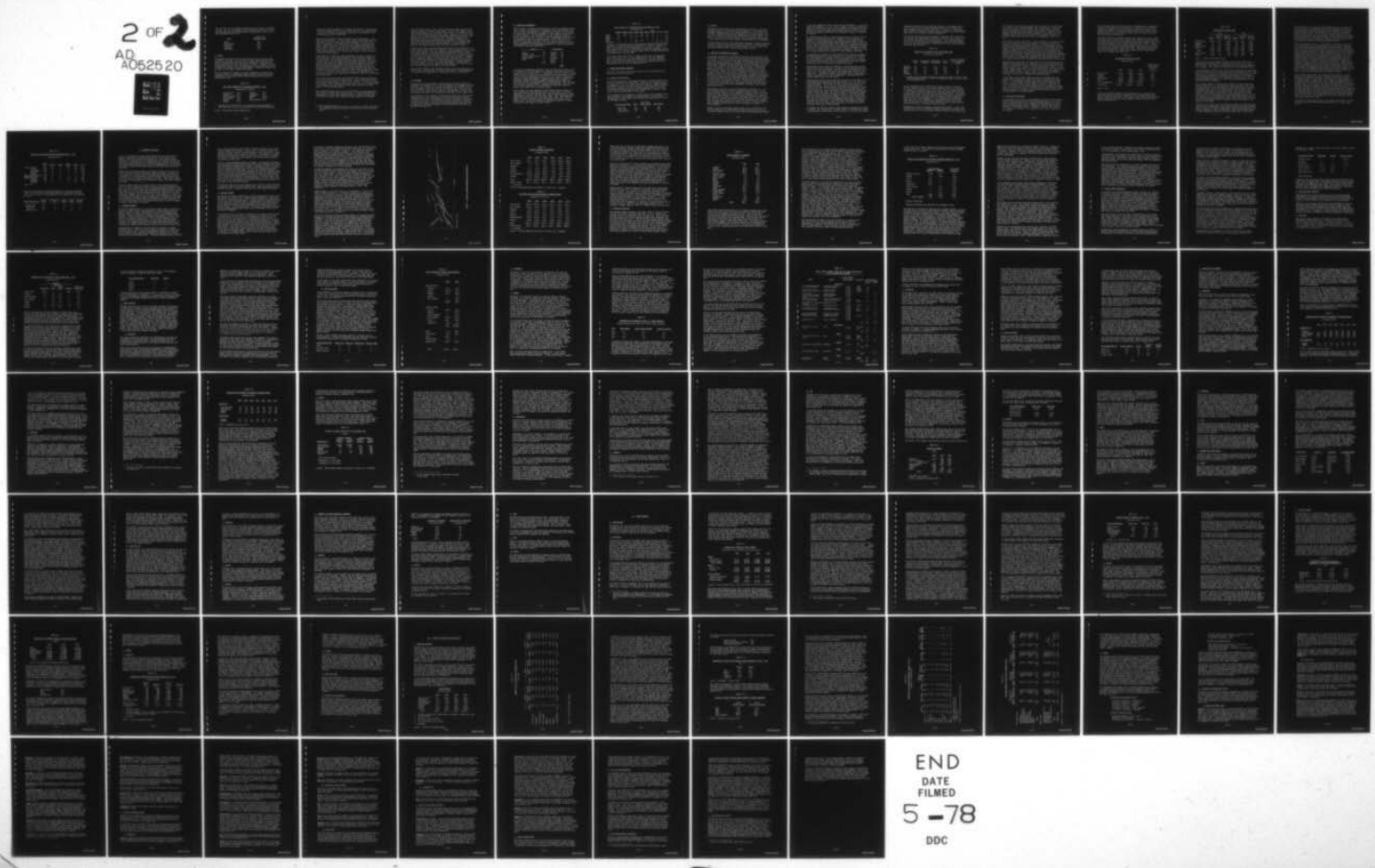

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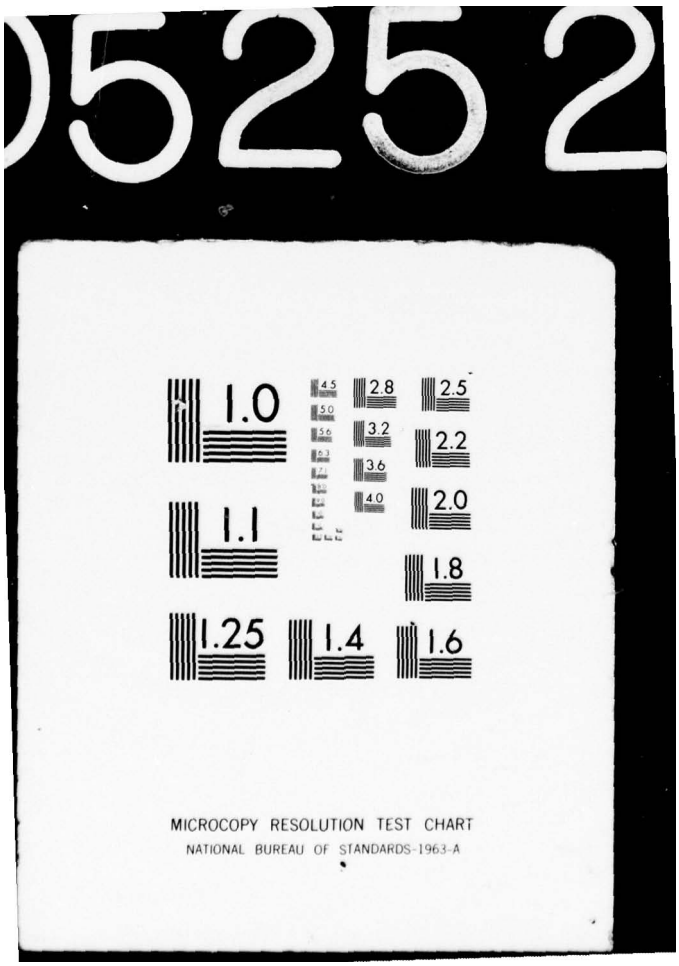
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The vast bulk of such shipments has been made in 15,000 to 30,000 dwt vessels. The size of shipments varies considerably from port to port. The following table gives the average load delivered to five of the more important ports in 1973.

Port	Average Load (thousand tons)
Odessa	30.2
Novorossiysk	28.2
Ilichevsk	29.3
Leningrad	21.6
Vladivostok	14.3

F. SUGAR

The Eastern Bloc imports 3-5 million tons per year of raw cane sugar, principally from Cuba. Over the next 25 years, Eastern Europe is expected to become self-sufficient in the production of sugar and the Soviet Union probably can do likewise if it wishes. However, political considerations and the fact that expenditures of hard currency are not involved will probably dictate Soviet imports of around 3.5 million tons per year of cane sugar, primarily from Cuba.

With the exception of Romania, the sugar consumption in Eastern Bloc countries already is surprisingly high, generally equal to per capita consumption in the advanced West European countries and the United States (Table IV-6).

TABLE IV-6

RAW SUGAR CONSUMPTION IN SELECTED COUNTRIES - 1975

(kilograms per capita)

Soviet Union	44.5	Romania	28.3
Bulgaria	59.6	Yugoslavia	30.5
Czechoslovakia	44.6	Albania	14.1
East Germany	41.6	EEC	36.7[a]
Hungary	50.5	United States	42.4[a]
Poland	47.0		

a. Consumption is low because of the relatively high consumption of other sweeteners such as corn sweeteners and artificial sweeteners.

Source: International Sugar Organization.

Soviet per capita consumption of refined sugar already is above the 40 kilogram[6] consumption norm and an average growth in total availability of only 0.7% per year is required to take care of the demands of the increasing population through 2000.

There are two principal sources of sugar in the Soviet Union -- cane sugar and sugar beets. In recent years, domestic sugar beets have supplied about 7 million metric tons of refined sugar or 70% of total Soviet consumption. The remaining 30% is refined from imported cane sugar. Sugar refineries in the Soviet Union refine sugar from both beet and cane sources, a practice that is considered uneconomic in the United States. Most of the beets are processed and refined from September through December while imported cane sugar is refined primarily from March through August.

Soviet imports of cane sugar come principally from Cuba, although at times other sources have included Brazil, Peru, Australia, Guyana and the Philippines. East European imports of sugar typically amount to 1 million tons, with Cuba usually accounting for about 80%. The amount actually imported by the Eastern Bloc from Cuba depends on the Cuban harvest, the world sugar market, and the Soviet sugar beet harvest. A 1975 trade agreement between the Soviet Union and Cuba calls for an annual quota of 2.5 million tons of raw sugar, slightly less than 50% of Cuba's normal production. However, in 1977 Cuba is expected to supply 3.5 out of a total of 4 million tons of sugar to be imported by the Soviet Union because Cuba temporarily has withdrawn from the international free sugar market.

The Soviet Union traditionally has subsidized Cuban sugar by purchasing it at a price above the world market price. Over the 1961-1973 period, this subsidy accumulated to a total of $1.1 billion. In 1974, when world prices rose so high, Communist prices also rose, but not so much as those in non-Communist countries and the Soviet Union recovered over $300 million of the previous subsidy.

East European countries plan to be self-sufficient in sugar production and, by the year 2000, they should succeed. If considered appropriate, improvements in Soviet beet production should be able to satisfy the 19% increase in sugar supply required to meet internal Soviet demand

6. The consumption norm in Table IV-2 is in terms of refined sugar while the comparison with other countries in Table IV-6 is on a raw sugar basis.

over the next 25 years. Some of this increase presumably can come from improved handling of domestic sugar beets. In 1976, for example, Soviet sugar beet production set a record of 98.6 million tons because of abundant moisture and the resulting high yields. However, 13.6 million tons were left on the farms because of harvesting difficulties and early cold weather while another 5-10 million tons, although purchased by the government, were not processed because of spoilage. Ultimately, the record 1976 beet production actually resulted in no more refined sugar than was recovered from the disastrous harvest of the preceding year when only two-thirds as many beets were grown (66 million tons).

However, since sugar typically represents over 90% of the total value of Soviet imports from Cuba, Soviet support of Cuba through purchases of sugar will likely continue. With the increasing worldwide demand for sugar, such support may not be required from the Cuban point of view, but it is one method by which Cuba can repay Soviet debts it has incurred. Another possible source of sugar for the Soviet Union would be Guyana. Although not a traditional supplier, Guyana did export some sugar to the Soviet Union in 1975 and if economic or political support is deemed appropriate for Guyana, sugar is one of the obvious mechanisms. We have assumed that in a normal crop year, Guyana and Cuba together will export a total of 3.5 million tons of raw sugar to the Soviet Union.

Odessa, where improved sugar handling facilities are being installed, is the principal receiving port for Soviet sugar imports, although Klaypeda on the Baltic and Vladivostok on the Pacific Coast also handle some.

G. POTATOES

The Eastern Bloc is essentially self-sufficient in potato production, although a few thousand tons do come from several West European countries. Normally, Soviet imports of potatoes run somewhat over 100,000 tons per year, compared to production of around 90 million tons. With the crop failure in 1972, potato imports rose to an unprecedented 1 million tons, principally from Poland, but subsequently returned to their normal level.

There should be little problem in achieving the Soviet per capita potato consumption norm of 97 kilograms since this norm represents a slight reduction from current total demand, even after the growth in population is taken into account. Although potato acreage and output in Eastern Europe and the Soviet Union has been declining gradually for some time, no significant imports of potatoes into the Eastern Bloc should be required in the year 2000.

H. FRUITS AND VEGETABLES

Eastern Europe is largely self-sufficient in fruit and vegetable production. However, the production of vegetables in the Soviet Union typically is under plan despite the relatively rapid growth rate in output in recent years and the high dependence of this segment of agriculture on private farmers. Fruit production has more often met plan, but Soviet consumers eat only one-third of the recommended consumption norm. The vegetable situation is somewhat better in this respect, but the population still gets only 60% of the norm. Nor is the variety of fruits and vegetables available as wide as might be desired as the following breakdown of 1974 government purchases of fruits and vegetables from domestic producers illustrates:

Fruits		Vegetables	
Grapes	37%	Cabbage	33%
Peaches, plums	14	Tomatoes	30
Apples, pears, berries	45	Onions	99
Citrus fruits	1	Cucumbers	9
Other	3	Beets	6
	100%	Carrots	6
		Other	7
			100%

To reach the recommended consumption norms by 2000 would require a two-fold increase in the availability of vegetables and almost a four-fold increase in fruits and berries. A significant portion of these increases could come about through improved handling because reportedly up to 40% of the fruits and vegetables grown are lost as a result of subsequent handling, storage and shipment. Measures being taken to improve this situation include developing irrigated land near large cities and industrial centers for the production of vegetables and, where this is not practical, the development of vegetable greenhouses. Not only will this increase production but, by reducing the time and distance to market, also should help to minimize losses.

Soviet imports of fresh vegetables have fluctuated quite widely, but have averaged about 200,000 tons per year, while imports of canned vegetables total another 350,000 tons. The principal sources of fresh vegetables are Bulgaria (50%) and Egypt (30%), while canned vegetables come primarily from Bulgaria (45%) and Hungary (45%). The sources of imports of fresh and dried fruits and berries, which total about 1 million tons, are more diversified as indicated by Table IV-7, which covers 95% of the imports of these products.

TABLE IV-7

SOVIET IMPORTS OF SELECTED FRUITS AND BERRIES IN 1974

(thousand tons)

	Bulgaria	Hungary	Egypt	Greece	China	Morocco	North Korea	Iran	Iraq	Others
Apples	18.9	218.5	--	--	64.8	--	27.7	--	--	8.0
Oranges	--	--	81.7	46.5	5.3	170.7	--	--	--	53.2
Grapes	59.7	--	--	--	--	--	--	--	--	0.1
Bananas	--	--	--	--	--	--	--	--	--	12.9
Lemons	--	--	--	35.4	0.2	--	--	--	--	45.9
Dried Fruits	0.3	--	--	6.3	--	--	--	31.0	23.3	33.8

Certainly, the increase in fruit and vegetable availability must depend primarily on increased domestic production, not imports. However, imports will probably increase moderately over the next 25 years as a wider selection of fruits and vegetables becomes more important. Ocean-borne imports may increase from the current level of around 300,000 tons to 500,000 tons in the year 2000.

It is likely that the majority of these products will be unloaded at ports on the Black Sea. We have assumed that in the year 2000 about 70% of the tonnage will come into the Black Sea, 20% into the Baltic Sea, and 10% into the Pacific Coast, and will originate 90% from the Mediterranean Sea and 10% from Southeast Asia.

I. OTHER AGRICULTURAL PRODUCTS

The other significant agricultural imports into the Eastern Bloc are coffee, tea, cocoa and cotton.

1. Coffee, Tea and Cocoa

In 1975 the Soviet Union imported 60,000 tons of coffee, 67,000 tons of tea, and 156,000 tons of cocoa beans. India was the principal source, accounting for 31% of the coffee and 93% of the tea. Brazil accounted for 42% of the coffee and 10% of the cocoa, while West Africa (principally Ghana, Nigeria and the Ivory Coast) supplied 85% of the cocoa. In 1975 Eastern Europe imported about 155,000 tons of coffee, 11,000 tons of tea and 125,000 tons of cocoa beans.

If one assumes that consumption of these products rises somewhat faster than population, total imports of these products will reach about 800,000 tons by 2000, broken down by source and destination as follows (in thousands of tons):

Destination/Source	India	East Coast South America	West Africa
Black Sea	120	100	200
Baltic Sea	90	90	170
Pacific Coast	10	10	10

2. Cotton

Although the Soviet Union is the only important producer of cotton in the Eastern Bloc, its supplies have been adequate to cover 60% of East European requirements and still permit 400,000 tons to be exported to the West. Eastern Europe imports 250,000 tons from other sources while the Soviet Union also imports over 100,000 tons of cotton itself. In 1975, if the Soviet Union had supplied total Eastern Bloc requirements, it still would have been able to export around 20,000 tons to the West.

It seems likely that the Soviet Union will continue to produce sufficient cotton to supply both its own requirements and those of Eastern Europe. Therefore, we have assumed that outside imports of cotton could be cut off from the Eastern Bloc without imposing undue hardship.

J. THE ROLE OF WEATHER AND CLIMATE

On balance, the imports of agricultural products into the Soviet Union and Eastern Europe at the end of the century will depend primarily upon two factors -- (1) how successful these countries have been in developing their agricultural sectors to withstand the inevitable years of adverse weather by developing improved varieties, better distribution and storage systems, increased storage facilities, and crop reserve systems; and (2) the weather in the particular year of concern. Because the desire on the part of the several governments involved is for self-sufficiency we believe that, where basic self-sufficiency is found to be impractical, either goals will be changed or alternatives will be adopted. Imports of certain grains still will be required periodically, particularly until the agricultural development programs are completed, but there is enough room for improvement and the priority being given to agriculture is sufficiently high to presume major success on this front is likely over the next 25 years. In this section, therefore, we focus on the possibility that the weather actually may work against the efforts of the Eastern Bloc governments to achieve their various agricultural goals.

Traditionally, the term "climate" has denoted the weather (i.e., the day-to-day variations) of an area averaged over many years. It has been recognized implicitly that climates do change, at least over long periods of time; otherwise, we would not find evidence of ice ages nor would there now be desert in areas of Africa and the Middle East that once supported thriving civilizations with their crops. But, in recent years, we have come to realize that climates change much more rapidly than was generally assumed in the past. In fact, at times it really is only a semantic question whether certain phenomena are weather- or climate-related.

Another ice age is still many thousand years away, comfortably out of the time frame of the present study; however, evidence over the past 1,600 years suggests that only 40 years separate the maximum and minimum

of the mean temperature cycle in the northern hemisphere -- a cycle that ranges over perhaps 3° to 4°F. Since a change in the mean temperature alters the world weather patterns and therefore the potential for food production in many localities, the possible effect on Soviet and East European agricultural production and consequently imports is important to consider.

The traditional approach to projecting agricultural yields has been to assume the climate of an area as a constant. That is, weather is assumed to be an unpredictable, but relatively constrained variable with years of good weather inevitably interrupted by years of poor and years of very favorable weather. This leads to the assumption that any upward trend in crop yield should be attributed to improved technology, and that the annual variations around this smooth technological trend line are to be attributed to the vagaries of weather. Thus, most long-term studies normalize the variable of extreme weather conditions.

In analyzing the relevance of this approach to the specific problem of estimating future Soviet crop yields, the CIA recently has concluded that the assumption of climatic stability is incorrect or, to put it in terms perhaps more palatable to traditionalists, there are medium-term weather cycles which, up to now, generally have not been evident within the "noise" of the annual weather fluctuations.

Climatologists do not deny the difficulty of predicting year-to-year and even day-to-day variations. However, they are concerned with the trend of the mean about which these year-to-year and day-to-day variations occur. And some believe they can discern these cycles in the weather (i.e., changes in climate) sufficiently well to judge where we stand in the present cycle and, consequently, to evaluate what the average tendency may be in the future.

Climatologists believe that during the first half of this century, the world experienced increasingly favorable weather, but that the cycle turned down after 1960 and now the world is well into a period of unfavorable weather. To look back to the previous such period, the climate of the late 1800's was quite difficult for agriculture in most areas of the world. In the United States the grain producing areas of the Midwest were cooler and wetter, extensive monsoon failures were common in China and India; snow lasted longer on the Russian steppes, and more extended periods of drought occurred in the areas included under the Soviet Virgin Lands program. Return to this climate would mean that the Soviet Union would effectively lose much of the 48 million tons of grain produced in Kazakhstan unless massive irrigation programs were carried out. India and China would experience famine every few years, and Canada would lose some of her grain production and export potential to colder weather.

To separate the effects on Soviet grain yields of technology from those of weather, the CIA developed a computer model to correlate past yields for spring wheat, winter wheat and all grain for 27 Soviet crop regions,

using monthly average weather data and estimates of technology derived from the residuals. The model developed explains 70% to 80% of the total variance exhibited in the data and the estimates of technology, when converted to fertilizer response rates, compare well with published Soviet data at the republic level of aggregation.

The results that were derived (presented in the Table IV-8) show quite convincingly that improvements in climatic conditions have played a key role in the increased yields in many regions. As an extreme example, over 80% of the increased yield in Kazakhstan, where the yield doubled, was due to the improved climatic conditions which that area experienced during the 1962-74 period.

TABLE IV-8

YIELDS OF ALL GRAINS IN THE SOVIET GRAIN BELT

(centners per hectare[a])

	Yield in 1962	Attributable to Weather	Attributable to Technology	Yield in 1974	Portion of Increased Yield Attributable to Weather (%)
Moldavia	23.6	-0.6	10.1	33.1	- 6
Belorussia	6.9	0.7	18.6	26.2	4
Baltics	17.9	4.7	13.8	27.1	25
RSFSR	11.4	2.8	3.0	17.2	48
Ukraine	17.9	4.9	4.8	27.6	51
Kazakhstan	4.5	4.2	1.0	9.7	81

a. A centner is 100 kilograms and a hectare is 10,000 square meters. For wheat (which weighs 60 pounds per bushel), a yield of 10 centners per hectare is equal to a yield of 14.9 bushels per acre.

In the traditional Soviet agricultural regions, which are located in the more temperate parts of the country, weather tends to be favorable for agriculture production most of the time. Here, the proper addition of fertilizer is virtually guaranteed to improve yields and it has been in such regions that fertilizer use has been concentrated. For example, the addition of more fertilizer and other technical inputs accounted for virtually the entire increased yield in Moldavia (40%) and Belorussia (28%) over the 12 years examined. It is estimated that, on average, about one-half of the increased grain production in the Soviet Union since 1962 has been a result of more favorable climatic conditions and one-half the result of increased technical inputs.

The question is what will happen to yields in the future. If the climatologists are correct, and the earth again experiences the weather that prevailed prior to the increasingly favorable climate of the recent past,

that portion of the increased yields that the Soviet Union experienced as a result of the improving weather will be eliminated. In the temperate crop regions of the Northwest, this climate change will make little difference because this area has had and will continue to have adequate precipitation and moderate temperatures even under less than optimum climatic conditions. However, the crop regions along the southern border and to the east, such as in Kazakhstan, will be hard hit.

The 1976-80 five-year plan calls for grain production to average 215-220 million tons per year during this period. To achieve this level of production, assuming a continued increase in the technological inputs to agriculture (predominantly the increased use of fertilizer, but also improved varieties, application of pesticides and more irrigation) will require a climate that is, on average, not quite as favorable as the average of the entire 1962-74 period, but which is considerably better than the 1962-65 period. However, those who carried out the CIA analysis believe that the climate in the 1976-80 period and subsequently will most likely return to the conditions experienced during the early 1960's. If so, average production will be reduced to about 200 million tons per year.

Average annual requirements for grain during the 1976-80 period are estimated at 225 million tons per year which, if the five-year production plan of 215-200 million tons is achieved, would require imports of 5-10 million tons per year. However, if the climatologist's fears prove well founded, imports would have to average 25 million tons per year to satisfy the "normal" demand. In such a case it is unlikely that imports actually would reach this level; rather, demand would be reduced, as took place in 1975-76, by reducing the feed requirements.

If the climate does change, wiping out many of the gains that have already been achieved, the Soviet Union will be hard pressed on many fronts. It is extremely unlikely, under these conditions, that the goals of a major increase in the standard of living in dietary terms could be achieved without regular massive imports of either meat or corn. The solution in this case would seem to be a lowering of demand, either by decree, some form of rationing or by allowing prices to rise. The choice would be a political one; the results would be the same -- reduced demand, not increased imports.

K. FISH AND FISH PRODUCTS

For purposes of this study we have regarded the fish and fish products landed at Eastern Bloc ports as bulk ocean-borne imports, not in the sense of being purchased from a foreign off-shore source, but rather as an essential product that is transported to Eastern Bloc ports in dedicated, ocean-going vessels. Landings of fish and fish products are expected to increase to 15.5 million tons per year by the end of the century.

The Soviet Union has already reached the recommended annual consumption norm of 18.6 kilograms of fish per person. Consequently, it might be assumed that growth of both the fishing fleet and catch would be only sufficient to cover the population growth of 22% over the next 25 years. However, growth in both the fleet and the catch are likely to exceed this level for several reasons.

The world ocean fish catch grew steadily after World War II from 18 million tons in 1948 to 60 million tons in 1970. However, the ocean catch then levelled out and has been essentially constant throughout the 1970's, fluctuating between 56 and 61 million tons from 1970 to 1975. During the 1960's, the Soviet catch increased almost twice as fast as the total world catch and, although increasing somewhat less rapidly since 1970, has continued to grow at almost 7% per year. The East European fleets also have increased their catches more rapidly than the total world catch, as is evident from Table IV-9.

TABLE IV-9

EASTERN BLOC OCEAN FISH CATCH

(million tons)

	1965	1970	1975	Average Annual Growth Rate 1970-1975 (%)
Soviet Union	4,273.5	6,398.8	8,932.2	6.9
Bulgaria	15.6	84.4	150.3	12.2
Romania	16.3	25.8	89.9	28.4
East Germany	219.9	306.1	357.8	3.2
Poland	279.9	451.3	777.4	11.5
TOTAL EASTERN BLOC	4,805.2	7,266.4	10,307.6	7.2
TOTAL WORLD	45,600	60,000	59,300	- 0.2

Source: FAO

One of the principal reasons for the increased catch by Eastern Bloc countries has been the active development of the fishing fleet which many of them have undertaken. Table IV-10 shows the many ships involved and the large size of those ships compared to those of the U.S. and Japanese fishing fleet.

TABLE IV-10

EASTERN BLOC FISHING FLEET

	1970			1975		
	Number	Thousand GRT	Average Size GRT	Number	Thousand GRT	Average Size GRT
Soviet Union	3,055	3,997	1,308	4,217	5,937	1,408
Bulgaria	17	55	3,235	34	94	2,765
Romania	8	23	2,875	30	103	3,433
East Germany	172	136	791	164	147	896
Poland	176	231	1,313	270	282	1,044
TOTAL	3,430	4,440	1,294	4,720	6,560	1,390
United States	201	74	368	1,743	398	228
Japan	2,386	978	410	3,149	1,217	386

Source: Central Intelligence Agency.

The Soviet Union is the largest fishing nation in the world, with over 4,000 vessels catching almost 9 million tons of fish or 15% of the world's catch. The countries of Eastern Europe are much less important but, together, still account for over 80% of the East European catch.

It was estimated in 1970 that the total practical harvest of traditional bony fish from the world's oceans would be around 80 million tons. While the fact that the world catch has been level at 60 million tons for six years does not necessarily invalidate this estimate, it does suggest that the maximum potential may be difficult to reach since it will involve exploiting new areas of the ocean and utilizing species not now generally known by consumers.

The increased catches by Eastern Bloc countries in recent years have been achieved largely at the expense of reduced catches by most other maritime nations. In the 1976-80 period, the Soviet Union is planning to expand its activity in the Western Pacific and to exploit deeper ocean areas that may help raise total ocean catch above its recent plateau. Other areas of the world's oceans, such as that off West Africa and in the Indian Ocean are not heavily fished at this time, but are believed to be rich enough to sustain significant yields as long as catches are properly distributed among various species and the areas are not over-harvested (which, of course, is true of fishing for any species in any ocean).

Fishing is one activity that the Soviets may engage in around the world without fear of retribution, hard currency drain or political interference, as long as the coastal regulations of the maritime nations of the world are respected. With more and more coastal waters being claimed by their adjoining countries, the Soviets would seem to have little

alternative but to fish more in international waters where harvesting is more difficult, the equipment and vessels required are larger and more technically sophisticated, and the catch consists of new and unusual varieties with which consumers are not familiar and therefore probably would not buy. But the Soviets are more likely to exploit such ocean resources than other nations. They already have the largest and most technically sophisticated vessels, their alternative sources of protein are costly, and their fish-eating tradition is not so constricting as in the more traditional maritime nations.

While the consumption norm for fish might be increased in an attempt to utilize fish as a partial substitute for meat, and the growth in Soviet and East European catches suggest this is feasible, consideration of the total world catch makes it questionable that the presently-utilized species can support a major sustained effort in this direction. However, while the direct per capita consumption of fish in the Soviet Union probably will not increase much above the present level, the potential for fish meal as an animal feed is considerable. With the extreme pressure on Soviet agriculture to produce animal feed, any relief than can be provided by increased availability of fish meal would be welcome. A number of species in the world's oceans are undesirable as human food, but would make good fish meal. These include currently unexploited species such as the oceanic squid and krill (a large species of zooplankton) that inhabit the Antarctic Ocean as well as anchoveta and menhaden, which already are the current source of fish meal. It has been estimated that a sustained harvest of 80 million tons per year of ocean squid and krill could be realized.

It would seem logical under the conditions that prevail to increase Soviet fish consumption as much as possible and therefore we have assumed an increase of about 40% in the Eastern Bloc ocean catch to 14 million tons by the year 2000. Over one-half of this increase will be required simply to maintain Soviet per capita consumption at its present level. If species such as ocean squid and krill are exploited, it seems reasonable to assume a tripling of the fish meal and oil production, which now is 500,000 tons per year derived principally from the waste products of species caught for human consumption. Considering the fish meal and oil that will be produced from the increased catch, an additional catch of 5 million tons of such species will be required but, since fish meal and oil represent about 15% of the catch weight, only 1.5 million tons of fish meal and oil will be landed if the processing is carried out at sea.

The "source" of such imports will be the oceans of the world. In 1975 the Soviet and East European catches were made in all oceans (Table IV-11).

TABLE IV-11

SOURCE OF THE MARINE CATCH OF THE EASTERN BLOC - 1975

(thousand tons)

	Soviet Union	Bulgaria	Romania	East Germany	Poland	Total
Atlantic, Northwest	1,167	28	2	113	188	1,498
Northeast	2,406	36	4	234	334	3,014
West Central	69	--	--	--	3	72
East Central	1,145	46	78	2	92	1,363
Southwest	9	--	--	--	--	9
Southeast	421	32	--	--	76	529
Mediterranean and Black Sea	350	9	6	--	--	365
Indian Ocean, Western	37	--	--	--	--	37
Pacific, Northwest	2,719	--	--	--	--	2,719
Northeast	573	--	--	12	59	644
East Central	31	--	--	--	26	56
Southwest	45	--	--	--	--	45

Source: FAO

Considering the likely increased exploitation of the areas mentioned earlier, we estimate the following breakdown for landings (as opposed to the catch) of fish and fish products in the Eastern Bloc (in millions of tons):

Source/Destination	Atlantic Ocean	Mediterranean Sea	Indian Ocean	Pacific Ocean	Antarctic Ocean
Barents Sea	5.0	--	.1	.1	.7
Baltic Sea	2.0	--	.1	--	--
Black Sea	2.5	.5	--	--	--
Pacific Coast	--	--	--	4.5	--

V. MINERALS AND METALS

It is in the resources of metals and minerals that the Soviet Union is generally regarded as having attained the goal of self-sufficiency. However, while this goal has been reached in a large number of metals and minerals, although often at a significant cost, success has not been universal. Eastern Europe, while being generally deficient in minerals, does contribute significantly to the Bloc's independence in certain cases, for example, Hungary with bauxite reserves and Poland with large copper resources.

Perhaps the most notable example of success is with iron ore where the Soviet Union has long been the world's largest producer, accounting for over one-quarter of gross total world output and supplying not only her own and most of the requirements of Eastern Europe, but also exporting 5 million tons of ore and concentrates to the West. Other major examples of success include manganese ore, chrome ore, copper, the precious metals and nickel.

The most notable example of failure has been in the aluminum industry where the lack of high-grade bauxite reserves historically caused dependence on low-grade bauxite and other low-aluminum-content materials. After many years of trying to reduce the inefficiencies associated with employing these materials, the Soviet aluminum industry has finally begun to import bauxite and alumina from some of the world's major deposits. Fluorspar, molybdenum, tungsten and tin also are short in the Eastern Bloc and, while we are generally optimistic about the possibility of additional resources being discovered as Eastern Siberia becomes more and more accessible, in the interim the Soviet Union and Eastern Europe will be forced to depend, at least to some extent, on imports.

A. ALUMINUM INDUSTRY

The Soviet aluminum industry, after trying for many years to achieve raw material self-sufficiency based largely on low-grade bauxite and non-bauxitic material, recently has been forced to rely increasingly upon foreign sources of bauxite and alumina to support its growing aluminum industry. While some bauxite is available from Hungary, the bulk of the bauxite and alumina required by the Soviet aluminum industry soon will come from outside the Eastern Bloc. In fact, of all the Eastern Bloc countries, only Hungary has substantial high-grade bauxite reserves. As a result, the aluminum industry in the Soviet Union and Eastern Europe developed in a manner quite different from that in the rest of the world.

Aluminum metal is produced by the electrolytic reduction of alumina (aluminum oxide). About two tons of alumina are required to produce one ton of aluminum metal. In most industrialized countries, the only raw material used for the production of aluminum is bauxite, most of which is imported from developing nations. The major high-grade bauxite deposits

(i.e., with an alumina content of 50% or better) generally occur in the tropical regions of the world. Since no part of the Soviet Union lies south of 35°N (the latitude of Cape Hatteras), major occurrences of good high-grade bauxite in fact would be an anomaly. Although such an anomaly has yet to be discovered, it has not been for lack of trying -- exploration aimed at filling the Soviet bauxite void has been both widespread and intense for many years.

Since not enough high-grade bauxite was found, a considerable percentage of Soviet aluminum production has been derived from low-grade bauxite and other aluminum-containing materials such as nepheline syenite and alunite that are available domestically. However, the alumina plants operating on such materials have been unable to reach their planned capacities. There is little doubt that future expansions of the Soviet aluminum industry will be based on imported raw materials and that even some existing alumina plants that were designed to process non-bauxitic materials will rely to an increasing degree on foreign bauxite. Of course, this trend will continue only as long as major bauxite deposits are not found in the Soviet Union, but the geology of that country and the lack of success so far makes a major discovery unlikely.

The questions then are how much expansion will there be in the production of aluminum? Where will new plants be built? What raw materials will be imported (bauxite or alumina)? And where will these imports originate?

1. Aluminum Demand

Considering the relative differences in the Gross National Product of the two regions, the Eastern Bloc consumes primary aluminum at a rate about 85% that of the United States, or at a level attained in the United States in the late 1950's and early 1960's. Consumption in the Eastern Bloc is low in large part because certain applications which are well developed in the United States are not major consumers in the Soviet Union and Eastern Europe. In the United States, for example, considerable aluminum goes to consumer-related applications, such as passenger cars, and for convenience packaging.

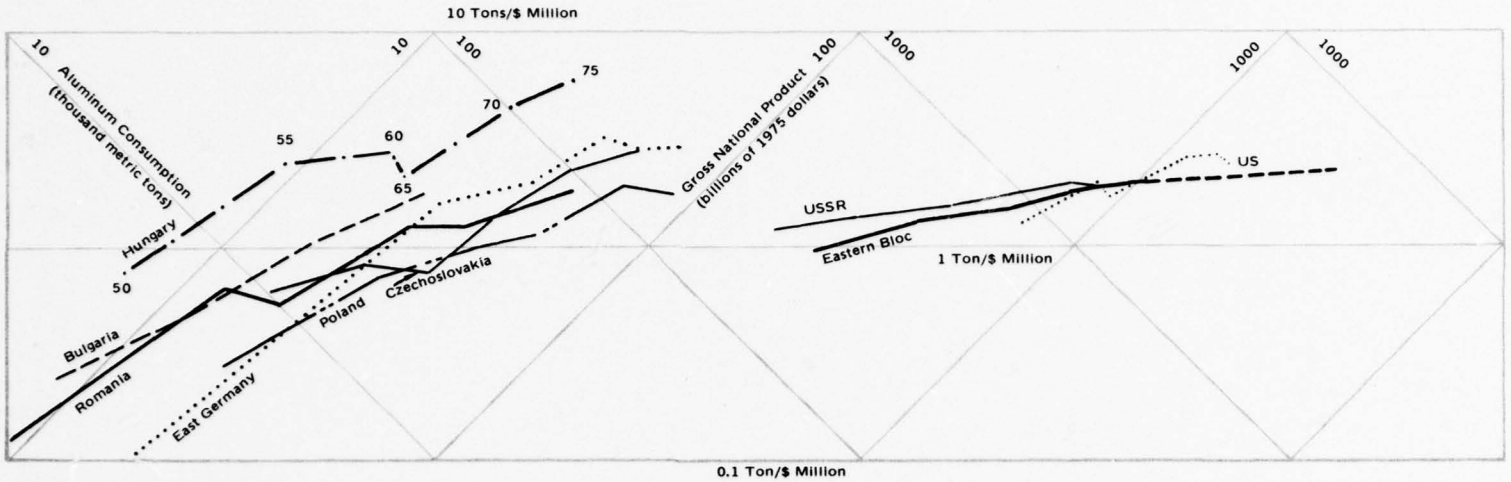
In the Soviet Union, the aircraft industry is the largest single consumer of aluminum mill products and, as a consequence, the Ministry of the Aviation Industry, not the Ministry of Nonferrous Metals, appears to have control over the fabrication of aluminum mill products. The rapid growth of the aluminum industry in the last decade was mainly to support the requirements of the Soviet defense and aerospace industries. Another major consumer of aluminum is as a substitute for copper in electrical applications. About two-thirds of all power cables produced in the Soviet Union in 1970 used aluminum conductors and this was scheduled to increase in subsequent years. Other sectors of the economy, such as construction and consumer goods, have not been important applications for aluminum in the Soviet Union.

The growth of aluminum consumption relative to the Gross National Product in the Soviet Union and Eastern Europe (individually and as a group) is shown in Figure V-1 and Tables V-1 and V-2. For comparison purposes, the United States has also been included. It will be noted that Hungary apparently consumes much more aluminum than would be expected considering its relatively low GNP. In fact, its apparent consumption of primary aluminum per dollar of GNP has consistently been well above that of the United States and the major Western European countries. This high rate of apparent consumption is due to the fact that Hungary produces and exports to her neighbors many aluminum-containing products such as electric wire and cable which are not excluded when calculating the apparent consumption of primary aluminum.

Aluminum consumption in the Eastern Bloc grew at an average of 10.9% per year during the period 1950-1970, but dropped off to 5.1% per year for the 1970-1975 period. During the same periods, GNP grew at 8.0% and 4.4%, respectively. We expect growth in aluminum consumption to slow even more in the future, to an average of 3.75% per year over the next 25 years, as the rate of growth of Gross National Product slows and as new applications for aluminum account for less of the total demand. Thus, by the year 2000 primary aluminum consumption in the Eastern Bloc is expected to reach about 6 million tons, approximately 2.5 times current consumption and equal to the specific consumption level attained in the United States in 1975. (See Figure V-1.)

Aluminum exports to the West also must be considered. In view of the lack of bauxite reserves, it is perhaps surprising that exports are a factor, but the Soviet Union for some time has exported significant quantities of aluminum to the West (for hard currency) in addition to supplying much of the East European demands, and we believe that a substantial increase in Soviet exports to the West could occur in the future. Traditionally, exports to the West were carried out under a "gentlemen's agreement" whereby the Soviet Union marketed aluminum only through major aluminum producers in Western Europe and Japan. Participating producers purchased Soviet aluminum at 10%-12% below prevailing prices. In the summer of 1976 the Soviets terminated this arrangement, presumably looking forward to the world shortage of aluminum projected for the late 1970's.

The Soviets view the Free World aluminum industry as being particularly dependent on "outmoded capitalistic ties" between the industrialized consumers on the one hand and the underdeveloped bauxite suppliers on the other. They see an opportunity to interpose themselves between these two groups, both politically and commercially, by importing bauxite or alumina, transporting it to Siberia where low cost hydroelectric power is used to produce aluminum, and then exporting the aluminum to the industrialized nations of the Free World. In such a scheme, the Soviet Union would, in fact, be exporting one of its most abundant and renewable resources -- hydroelectric power. Such exports also would provide a major backhaul (east to west) for the trains that will be carrying export goods from the Soviet interior to the Pacific coast.



Source: Tables V–1 and V–2.

FIGURE V–1 GROWTH OF ALUMINUM CONSUMPTION IN THE EASTERN BLOC

Arthur D Little Inc

TABLE V-1

PRIMARY ALUMINUM CONSUMPTION

(thousand tons)

	1950	1955	1960	1965	1970	1975
Soviet Union	215.0	365.0	632.0	971.0	1330.0	1580.0
East Germany	2.0	40.0	75.0	140.0	155.0	200.0
Bulgaria	(-)	(-)	(2.0)	4.5	16.5	40.0
Poland	5.0	20.0	39.8	58.0	120.0	150.0
Romania	(0.3)	(8.0)	(10.0)	31.0	40.0	90.0
Czechoslovakia	(10.0)	(20.0)	(26.0)	51.0	107.0	155.0
Hungary	(5.0)	(22.0)	40.2	38.7	92.0	166.0
TOTAL	(237.3)	(475.0)	(825.0)	1294.2	1860.5	2381.0
United States	823.0	1581.8	1541.2	2852.4	33488.3	3532.0

( ) estimated

Sources: Metallgesellschaft and Arthur D. Little, Inc., estimates

TABLE V-2

ESTIMATED GROSS NATIONAL PRODUCT AT MARKET PRICES

(billion 1975 U.S. $)

	1950	1955	1960	1965	1970	1975
Soviet Union	(181.0)	(270.0)	422.4	563.0	719.2	865.3
East Germany	(19.2)	(26.3)	38.6	45.2	55.5	70.2
Bulgaria	(4.0)	(5.3)	8.5	11.6	16.4	23.1
Poland	(19.3)	(29.0)	40.6	52.4	64.8	89.9
Romania	(6.8)	(13.0)	19.0	25.2	33.8	51.4
Czechoslovakia	(16.9)	(24.8)	35.0	37.6	45.7	56.6
Hungary	(6.9)	(9.4)	15.3	18.9	22.7	27.8
TOTAL	(254.1)	(377.8)	579.4	753.9	958.1	1184.3
United States	670.0	830.0	925.0	1170.1	1358.8	1498.9

( ) estimated

Sources: CIA 1976 Handbook and Arthur D. Little, Inc., estimates

Exporting power in the form of high-power-consuming materials is not a new idea; indeed, Norway's production of magnesium and ferroalloys has been predicated on exactly the same premise. And, with the cost of energy in virtually all other parts of the world tied to cartel-priced Middle Eastern oil, there will be an increasing price umbrella to cover the cost of transporting raw materials to the source of this low-cost power (0.2 kopecks per kw-hr) and exporting aluminum back to the consuming nations of the Pacific Basin and possibly other countries of the Free World.

There are no firm plans for such a scheme, but some Soviet authorities propose construction of a 1.1-million-ton alumina plant located on the East Coast, possibly operating on Australian bauxite. On the surface, however, this proposal takes little cognizance of the desire of the bauxite-producing nations of the world to increase the value added in their own country by exporting alumina rather than bauxite. For example, Australia will not permit bauxite produced in any new facility to be exported in any form other than as alumina or aluminum metal. While the Soviet Union may continue to be able to barter capital facilities for future deliveries from underdeveloped nations, it is likely that by 2000 such agreements will involve importation of a major percentage of the aluminum-containing raw materials in the form of alumina.

Recent exports of aluminum from the Soviet Union have totaled about 500,000 tons per year -- 375,000 tons to Eastern Europe and 125,000 tons to the West. (See Table V-3.) France and the Soviet Union recently signed an agreement whereby France will help build a 1-million-ton-per-year alumina plant on the Black Sea and a 500,000-ton-per-year aluminum reduction facility at Sayanogorsk in Siberia. In return, the French will be able to purchase 50,000 tons per year of the aluminum produced in this facility over a period of 10 years. We expect other such arrangements, in addition to production destined for straight exports to the West, will add another million tons of aluminum to demand, making a total of 7 million tons by the year 2000.

2. Aluminum Production

The aluminum industry started in the Soviet Union in the early 1930's with two electrolytic reduction facilities -- one at Volkhov near Leningrad and one at Zaporozh'ye near the Black Sea. Both facilities utilized bauxite from the Boksitogorsk deposit (near Leningrad) that had been discovered in 1916. Although the Boksitogorsk deposits were the first to be developed, and for a long time constituted the principal raw material for the reduction plants located in the northwestern part of the Soviet Union, the bauxite here was low grade (41-48% alumina, 10-20% silica) and the reserves were limited. In the early 1960's, nepheline from the Kola Peninsula became the principal source for production of alumina for this group of reduction facilities and the Boksitogorsk bauxite now is used to produce abrasive-grade alumina.

TABLE V-3

SOVIET EXPORTS OF ALUMINUM

(thousand tons)

	1974	1975
Bulgaria	22.6	23.5
Hungary	96.5	101.5
East Germany	109.9	114.5
Poland	40.6	33.2
Czechoslovakia	97.6	90.3
North Vietnam	.5	.8
North Korea	1.5	1.5
Egypt	1.3	1.7
Norway	6.0	9.2
Finland	7.9	8.0
France	8.9	11.6
Yugoslavia	26.7	15.9
Japan	41.7	42.9
United Kingdom	22.1	19.5
Netherlands	22.3	5.2
United States	--	8.7
Brazil	3.1	--
Switzerland	3.9	1.4
Belgium	1.9	1.0
Other	13.7	12.0
TOTAL	528.7	502.4

Just before and during World War II the industry expanded about 1,000 miles to the east in the Urals where two reduction facilities were constructed (at Kamensk and Krasnotur'insk). These facilities utilized higher grade bauxite that had been discovered at Severoural'sk and which is exploited by underground mines. Also at this time the first reduction facility was constructed in Eastern Siberia, at Novokuznetsk, another 1,000 miles further east. This plant utilized much of the equipment that had been evacuated from the Volkhov and Zaporozh'ye plants because of the war. By the end of World War II in 1945, Soviet aluminum production had reached about 85,000 tons per year.

In the 1950's the Soviet aluminum industry expanded in European Russia with the rebuilding of the Volkov and Zaporozh'ye plants and construction of five additional reduction facilities. The two plants built on the Kola Peninsula -- at Kandalaksha and Nadvoitsy -- were the first to utilize a non-bauxite raw material -- in this case nepheline, a by-product of the apatite mining operations at Kirovsk. The others -- at Yerevan, Sumgait and Volgograd -- were built in the southwest and were designed to utilize alumina produced from a local alunite deposit. However, delays and below-capacity operation of the alumina facility that was built at Kirovabad to process this alunite forced these reduction plants to depend on alumina shipped in by rail from the Urals and the Leningrad district or imported from Hungary via the Danube and Black Sea. The other reduction facility in this region, at Zaporozh'ye, utilized bauxite from the Boksitogorsk deposit until 1956, when it switched to bauxite imported from Greece via the Black Sea. During this period, Soviet aluminum production grew from around 160,000 tons in 1950 to 430,000 tons in 1955 and 550,000 tons in 1960, at which time 20% of total Soviet aluminum production was based on Greek bauxite.

The 1960's ushered in a new phase of expansion in the Soviet aluminum industry based on utilizing low-cost hydroelectric power generated in Eastern Siberia. Three new reduction facilities were constructed during the 1960's -- at Shelekhov (1962), Krasnoyarsk (1964), and Bratsk (1966) -- to join the one already operating at Novokuznetsk. By 1965, the East Siberian plants accounted for 35% of the total Soviet aluminum output of 1 million tons -- and this rose to 65% of the 1.7 million tons produced in 1970. Based on the earlier success in utilizing Kola nepheline to produce alumina for the reduction facilities in European Russia, Soviet planners developed another nepheline deposit at Achinsk to serve reduction plants in Eastern Siberia. Although construction on this 800,000-ton-per-year alumina facility reportedly started in 1955, it was 1972 before the plant was completed and in 1975 it still could not produce more than 550,000 tons per year of alumina. In addition, local markets cannot absorb the seven tons of cement produced with every ton of alumina. Consequently, the complex is uneconomic. After this poor experience, Soviet planners decided they had done "enough experimenting" and resolved to "get back to plants using bauxite." As a result, earlier plans for expanding the use of Kola nepheline have been abandoned and a nepheline project in Armenia, begun in 1960 and still nowhere near complete, also will be abandoned.

The regrouping also extends to the use of alunite. On stream since 1966, the 10-year-old alunite-based Kirovabad alumina plant in Azerbaydzhan is producing only 200,000 tons per year of alumina, one-half its design capacity. The revised goal for this facility is to reach capacity operation by 1980, utilizing imported bauxite.

In 1975 only 37% of Soviet aluminum production was derived from domestic sources (Table V-4). The sources of raw material for Soviet aluminum production were as follows:

TABLE V-4

SOURCES OF RAW MATERIAL FOR SOVIET ALUMINUM PRODUCTION - 1975

(million tons)

	Raw Material		Recoverable
	Bauxite	Alumina	Aluminum
Domestic Sources	5.80[a]	2.90	1.45
Hungary	--	0.40	0.20
Guinea	1.84	--	0.46[b]
Greece	0.61	--	0.15
Yugoslavia	0.95	--	0.24
United States	--	0.11	0.06
Jamaica	--	0.17	0.08
Guyana	--	0.12	0.06
Other	0.08	0.23	0.13
TOTAL IMPORTS	3.48	1.03	2.37

[a]Bauxite equivalent

[b]Believed stockpiled and therefore not included in total

The importance of foreign raw materials will increase rapidly. Two more reduction facilities will be added during the 1970's, both of which are associated with new hydroelectric projects. The Regar facility, opened in 1975, is located in Central Asia and originally was designed to utilize kaolin from a nearby deposit. The lack of success with non-bauxite alumina sources presumably has forced this facility to utilize imported alumina. The second reduction facility, to be placed into operation by 1980, is another addition to the Eastern Siberian group of plants and is the one mentioned earlier in which the French are involved. Located at Sayanogorsk, this 500,000-ton facility will utilize electricity generated by the largest power plant in the world, the 6.4-million-kilowatt Sayan hydroelectric station now under construction on the Yenisey River. This facility will utilize alumina from a plant to be constructed at Nikolayev, 3,000 miles away on the Black Sea. The Nikolayev plant will utilize Guinean bauxite which already is being

imported and stockpiled for use when the facility starts up. During the 1980's the Soviet Union plans to build at least two additional aluminum facilities in Siberia, each with a production capacity of 500,000 tons of aluminum. Obviously, this total capacity would be well above projected domestic requirements for aluminum, and thereby would further increase export capabilities.

Hungary has three aluminum reduction facilities with a total capacity of about 90,000 tons per year. Hungary also imports aluminum primarily from the Soviet Volgograd reduction facility, in payment for alumina supplied to that plant, but much of this is reexported to the West and other East European countries. Hungary's three alumina plants have a combined capacity of 700,000 tons per year, but exports account for 90% of alumina production. Over one-half of the exports are to the Soviet Union under a long-term agreement for the exchange of alumina for Soviet aluminum, and most of the remainder is to other East European countries. Hungary produces 2.75 million tons of bauxite, of which about 600,000 tons is exported to other East European countries. A new 450,000-ton-per-year bauxite mine started up near Tapolca in Western Hungary in 1976 while the 450,000-ton-per-year Deak mine is scheduled to start up in 1980.

In 1972 Hungary's total bauxite reserves were estimated at 150 million tons which included 76 million tons of "minable reserves", a 25% decrease since 1969. Alumina shipments from Hungary to the Soviet Union were scheduled to increase to 330,000 tons per year by 1980. However, considering that the quality of Hungarian bauxite is deteriorating, there is considerable question about the long-term viability of Hungary as a bauxite producer since at the current rate of production, "minable reserves" will be depleted by the year 2000. Any reduction in Hungary as a producer will force both Eastern Europe and the Soviet Union to become more dependent on Western raw materials for their aluminum production.

East Germany has two aluminum reduction facilities with a total capacity of 90,000 tons per year. East Germany's 50,000-ton-per-year alumina plant operates on bauxite imported from Hungary and Yugoslavia, while the additional alumina requirements are imported from West Germany and Hungary. East Germany's domestic aluminum production accounts for a little less than one-half of total consumption. The remainder is satisfied by imports of primary aluminum, 95% of which comes from the Soviet Union, plus about 30,000 tons of mill products which are imported from various sources. Plans are to expand East Germany's alumina capacity by 140% and primary aluminum reduction capacity by 265%. This would make East Germany essentially self-sufficient in aluminum, but would still require the importation of alumina and bauxite since there are no domestic bauxite reserves.

Romania has one aluminum reduction facility with a capacity of 200,000 tons per year. Two 250,000-ton-per-year alumina plants, one near the Oradea bauxite mines and the other in the Danube Delta near Tulcea, will satisfy alumina requirements. Domestic bauxite production has been about 350,000 tons per year and the remaining requirements have come from Greece (60%) and Yugoslavia (40%). Romania exports a significant portion

of the aluminum produced. Bulgaria has no primary aluminum production and relies on imports from the Soviet Union (70%) and Western Europe for its requirements of about 40,000 tons per year.

Czechoslovakia, with production of 50,000 tons of aluminum, satisfies one-third of its requirements; the other 100,000 tons are imported from the Soviet Union. Production of 100,000 tons of alumina is based on imported bauxite, 60% of which comes from Hungary, 30% from Yugoslavia and 10% from India.

Poland produces about 100,000 tons of primary aluminum, two-thirds of its requirements. The remaining aluminum is imported primarily from the Soviet Union and other East European producers. With no economic bauxite deposits, Poland has been dependent on imports of bauxite (125,000 tons) and alumina (250,000 tons). These have come principally from Hungary (90% of the bauxite and 50% of the alumina)but also from the United States, Yugoslavia (alumina) and Australia (bauxite). During the next 10 years, however, Yugoslavia will replace other Western sources by supplying 120,000 tons per year of alumina. In addition, a 100,000-ton-per-year alumina facility is under construction which will utilize domestic high-alumina clays. To be completed in 1978, this plant will have to operate significantly better than similar Soviet facilities to provide an economic advantage over imports.

3. Future Import Dependence

As a result of the limited Hungarian bauxite reserves, the countries of Eastern Europe will become more dependent on ocean-borne imports of bauxite and alumina. In addition, the Soviet Union is likely to become a more important supplier of aluminum metal to Eastern Europe than it is now because of the favorable economics associated with production of primary aluminum based on Siberian hydroelectric power. This will also tend to offset the reduced oil supplies available to Eastern Europe from the Soviet Union. As noted earlier, Hungary exports bauxite and alumina to Eastern Europe and the Soviet Union. However, since these are handled by inland transportation routes (alumina to the Soviet Union is shipped down the Danube to the Black Sea), they are excluded from this study.

With the scarcity of low cost power in Eastern Europe it is likely that these countries will continue to rely on the Soviet Union for most of their aluminum. While much of this probably will be shipped from plants in Eastern Siberia via traditional inland transportation routes, some of it may be shipped to the Soviet Pacific coast to be transported by ship to countries such as East Germany. However, since such shipments could be handled by inland transportation facilities in an emergency, they also have been excluded.

Assuming that planned expansions in aluminum reduction facilities in Eastern Europe are completed and that all increased requirements in raw materials in the next 25 years will come from overseas sources,

total Eastern Bloc imports of aluminum in raw materials in the year 2000 will reach 4.8 million tons -- equal to 9.6 million tons of alumina or 19.2 million tons of bauxite. We have assumed that two-thirds of this requirement will be obtained as alumina and one-third as bauxite, giving ocean-borne imports 6.8 million tons of alumina and 6.7 million tons of bauxite.

Greece has been a traditional supplier of bauxite to the Soviet Union, shipping into the Black Sea in vessels as large as 20,000 tons, and also has supplied small amounts of bauxite to Czechoslovakia. The Greek government has imposed a limit on total bauxite exports of 1.5 million tons per year and, although not up to this level yet, it is unlikely that more than 750,000 tons of bauxite will be available to the Eastern Bloc from this source. Yugoslavia also has supplied major quantities of bauxite to the Eastern Bloc, but this source also is limited to about the current level and is upgrading to alumina as noted earlier.

To support its growing aluminum industry in the face of the necessary switch away from traditional domestic raw materials, the Soviet Union has had to deal with many potential sources of raw materials. In most cases the arrangements being concluded are similar to those offered to Western companies seeking Soviet raw materials -- construction of the bauxite mine or alumina plant using Soviet funds, technology and equipment which is paid off by future exports of material produced by the facility.

Presumably drawing on credits earned in the past when the Soviet Union helped develop the Indian aluminum industry, India contracted to supply 40,000 tons of alumina in 1976 and probably thereafter. In 1976 the Soviet Union signed an agreement with Turkey to analyze the possibility of doubling the Seydisehir aluminum complex to 400,000 tons of alumina and 120,000 tons of aluminum. The Soviet Union is to supply construction materials and technical personnel in return for which it will receive 140,000 tons per year of alumina.

The Soviet Union also helped the Republic of Guinea with the construction of a 2.5-million-ton-per-year bauxite mining complex in the Kindia area and port facilities at Conakry. Of the output, 90% will go to the Soviet Union under a 30-year trade agreement (with shipments starting in 1974) while the remaining 10% will be sold by Guinea on the open market. Through 1975, 2.3 million tons of bauxite had been shipped from Conakry to the Black Sea, of which 1.2 million tons was in repayment for Soviet participation. Shipment is made in 24,000-ton vessels. Finally, the Soviet Union has offered to finance the 600,000-ton-per-year alumina plant being considered for Bintan Island with a loan of $300 million for 10 years at 7%. This Indonesian facility, in which Kaiser Aluminum once considered investing, would start up in the 1980's.

Considering these arrangements, and the world resources of bauxite that will be available at the end of this century, we expect the

Eastern Bloc to import alumina and bauxite in the year 2000 as follows (in millions of tons):

Source/Destination	Black Sea[a]	Baltic[a]	Pacific Coast[a]
Southeast Asia	--	--	1.5/2.5
Australia	--	--	-/.7
West Africa	2.0/-	--	1.2/2.0
Central America	-/.2	.1/.1	--
South America	-/.6	.2/.1	--
Mediterranean Sea	1.7/.3	.1/.2	--

[a]Bauxite/alumina

Although to date relatively small vessels have been employed in this trade with the Eastern Bloc, much larger ships are to be utilized in the future as evidenced by the construction of a major bauxite import terminal in the Odessa/Nicolayev range. This facility, to be completed in 1978, reportedly will accommodate vessels up to 100,000 dwt and will have an unloading rate of 3600 tons per hour.

B. IRON AND STEEL INDUSTRY

Although the iron and steel industry is one of the most important participants in the bulk ocean-borne shipping of the other industrially developed regions of the world, it is not in the Eastern Bloc because of the very large iron ore deposits in the Soviet Union.

Imports of steel products from the West are principally of the more specialized items originating mainly in Western Europe and Japan. Line pipe presently is the single largest steel product import and an average of 1 million tons per year is expected to be imported over the next 25 years. In addition, 2 million tons per year of imported rolled steel product probably will utilize ocean-borne transportation.

1. Iron Ore

The iron and steel industry of the Eastern Bloc depends almost exclusively on Soviet iron ore. The Soviet Union is by far the world's largest iron ore producer. As shown in Table V-5, all but one of the East European countries must import the bulk of its iron ore requirements, and in each case the vast majority of those imports is supplied by the Soviet Union.

TABLE V-5

SELECTED DATA ON IRON ORE IN THE EASTERN BLOC - 1973

(million tons)

	Iron Ore				
		Imports			
	Production	Total	Soviet Union	Exports	Crude Steel Production
Soviet Union	383.8	--	--	41.4	131.5
Bulgaria	2.8	1.9	1.6	--	2.2
Czechoslovakia	1.7	13.2	11.6	--	13.2
East Germany	--	1.8	1.5	--	5.9
Hungary	.7	3.7	3.6	--	3.3
Poland	1.4	13.7	11.1	2.0	14.1
Romania	3.2	9.5	5.8	--	8.2

The iron ore resources of Eastern Europe are limited and, while several countries probably will continue to supply a minor percentage of their own requirements, any growth in their respective steel industries will have to be based on imported ore. Even Romania, which now supplies about half of its requirements from domestic mines, will become increasingly dependent on imported iron ore in view of its expanding steel industry and expected stable iron ore production.

Although some Western ore will continue to be imported (for example, Swedish ore into Poland), the Soviet Union is expected to at least maintain, and in all likelihood increase, its dominance of the iron ore flowing into Eastern Europe. Even in the case of Poland the Soviet Union supplies 85% of the imported iron ore. Agreements between many East European countries and the Soviet Union for the development of Soviet iron ore facilities and delivery of the product to Eastern Europe were signed in 1974. Under these agreements, the CMEA countries are to supply machinery, equipment and materials necessary for increasing Soviet production of iron ore concentrates (including pellets), in return for which they will receive more exports of iron ore concentrates from the Soviet Union.

In recent years India has been the principal non-Eastern Bloc source for iron ore, with about 3 million tons destined for Czechoslovakia, Hungary and Romania going into the Black Sea. Algeria also supplies over one million tons to Romania. In the Baltic, Poland receives around 2 million tons of ore from Sweden and Brazil. For the year 2000 we have assumed nominal increases in iron ore imports from each

of these regions as follows (in millions of tons), with remaining import requirements coming from the Soviet Union:

Source/Destination	Black Sea	Baltic
India	4	--
Algeria	2	--
Sweden	--	2
Brazil	--	1

Ports discharging iron ore in Eastern Europe -- Constanza in Romania and the Polish port of Swinovjscie -- are presently limited to vessels of up to 35-40,000 dwt, although the new North Port ore terminal under construction at Gdansk (Poland) will be able to handle 100,000-ton vessels.

2. Steel Products

Although the Soviet Union also is the world's leading steel producer, the high level of output is quite misleading when one considers the current availability of technically sophisticated steel products to Soviet industry. Such steel products are somewhat less of a problem in Eastern Europe. As discussed in a previous chapter, the management system employed by Soviet steel plants favors the production of large quantities of standard, relatively low-grade products, but a dearth of high-technology items. The Soviet press is replete with claims that shortages of such products -- from drill steel to sheet products -- are preventing combines across the country from meeting their own individual quotas on time. In most instances, importation of such steel products from the West is not a realistic alternative. Rather, Soviet industry must utilize what is available domestically and is lucky to get what they need on time. Only in the case of critical applications are imports considered.

a. Line Pipe

The largest single such application is large-diameter line pipe for transporting oil and natural gas. With oil and natural gas found principally in the Siberian Arctic, pipelines destined for the heavily industrialized sections of the country to the south and west receive high priority.

There are not many facilities for the production of large-diameter pipe around the world, the principal ones being in the United States, Western Europe, Japan and the Soviet Union. The Soviet production of line pipe is concentrated in five major facilities, the largest of which is at Chelyabinsk in the Urals. Two new plants are planned. One, to produce up to 2 million tons of pipe up to 48 inches in

diameter, is being built at Vyksa in the Urals; the second, to produce 48-inch and 56-inch diameter pipe, is to be constructed in West Siberia, possibly by Nippon Steel using Japanese money. These facilities would increase Soviet production capacity by about one-third.

Soviet capacity for manufacturing large-diameter pipe has lagged demand. Production during the period 1971-75 is estimated to have been only 11 million tons, of which about 7 million tons were 40-inch diameter and larger. Total demand during this period was approximately 17 million tons, requiring pipe imports of 6 million tons. Even if the new production facilities come on stream as planned, imports during the 1976-80 five-year plan will continue to average about 1 million tons per year.

The Soviets appear to have made a conscious decision not to build sufficient line pipe production capacity to serve their requirements -- a decision that is quite contrary to their usual philosophy of self-sufficiency when possible. The rationale behind such a decision probably rests on the fact that line pipe facilities are virtually useless for anything else because nothing else requires high-strength pipe over 4 feet in diameter. Thus, line pipe facilities are virtually useless for production of military goods and, in the future when oil and gas line construction grows less rapidly and not so much line pipe is required, excess facilities would have to be shut down. Finally, the Western steel industry has developed special high-strength, low-alloy line pipe steels -- a development not matched by the Soviet steel industry. Soviet line pipe is not as suitable as Western pipe for the extremely cold conditions in the Arctic where much of the oil and gas line construction is taking place.

The recent development in the West of double desulfurized steel for line pipe, if and when adopted by the Soviet steel industry, could change the attitude toward adding more line pipe capacity. However, such steel has been used in limited quantities in line pipe applications in the West and, with the long time required for most new developments to be adopted in the Soviet Union, it is unlikely to be a major factor in the near future.

Considering these factors and the many other demands on the capital available to the Soviet steel industry, we believe it is unlikely that adequate line pipe production facilities will be constructed. Therefore the Soviet Union will continue to depend on Western sources for some of its line pipe requirements. We have assumed that throughout the period of interest in this study, Soviet imports will amount to about 1 million tons of line pipe per year.

We have assumed three-quarters of this line pipe will come from Western Europe, much of which will be shipped by sea to the river ports in Northern Siberia nearest to the gas fields being exploited. In the late 1960's, for example, 600,000 tons of line pipe were transported

along the Northern Sea Route to Dudinka on the Yenisey River to construct the Messoyakha-Noril'sk line. (Much of this pipe was delivered to the construction site by helicopter.) Japan will supply the other 250,000 tons of line pipe, most of it probably along the Northern Sea Route or the Pacific Coast ports of the Soviet Union.

If the supply of line pipe from the West were disrupted for any reason, there would be no immediate impact on the Soviet economy; the impact would come only when the oil or gas lines for which the pipe was destined failed to come on stream when planned.

b. Rolled Products

Soviet imports of rolled steel products increased from 1.5 million tons in 1970 to 5.0 million tons in 1974, and then fell back to 3.9 million tons in 1975. The increase came principally from Western Europe and Japan, as shown in Table V-6.

By the end of the century we expect the Soviet Union and East European steel industries will be able to produce the steel mill products that are required, but now are short -- cold rolled steel, high-quality tubing, and electrical steel. Furthermore, as higher-quality steel products become available to Soviet industry, the amount of steel required to accomplish a given job will diminish, as it has in the West over the past 20 years. This trend will mean that, to serve the demands placed upon it, the steel industry's output will not need to increase as rapidly as in the past. While this will require changes in political and management philosophy, we believe the economic difficulties to be encountered in the mid-1980's will force such changes to be initiated, and that by 2000 the industry will reap at least some of the benefits. There will still be some imports from Western Europe and Japan, but these probably will be made primarily to minimize transportation costs. Thus, Japan may export a number of steel products to the Soviet Pacific Coast that, under emergency conditions, would be available by rail from Soviet facilities to the west. A similar situation could well exist with shipments between Western and Eastern Europe.

Overall, we have assumed ocean-borne imports of 2 million tons of rolled products, 1 million from Southeast Asia and India and 1 million from Western Europe, split as follows (in millions of tons):

Source/Destination	Baltic Sea	Black Sea	Barents Sea	Pacific Coast
India	.2	.1	--	--
Southeast Asia	--	--	--	.7
Western Europe	.5	.2	.3	--

TABLE V-6

SOVIET IMPORTS OF ROLLED STEEL PRODUCTS

(thousand tons)

	1970	1975
Eastern Europe:		
Bulgaria	115.1	46.9
Poland	287.0	157.6
Romania	217.5	108.8
Hungary	--	47.5
East Germany	--	36.4
	619.6	397.2
Western Europe:		
Austria	100.9	191.6
Belgium	--	583.7
United Kingdom	--	145.1
West Germany	156.0	997.2
France	160.7	130.5
Yugoslavia	36.7	51.1
	454.3	2,099.2
Japan	77.4	889.7
North Korea	91.9	119.7
India	164.4	--
United States	17.5	--
Unspecified	110.2	391.9
TOTAL	1,535.3	3,897.7

C. FLUORSPAR

Fluorspar is one of the few industrial raw materials for which the Soviet Union relies on imports for the majority of its requirements. Consumption of fluorspar in the Soviet Union at present is estimated to be 1 million tons while the East European countries consume another 250,000 tons. Eastern Bloc production covers only about 50% of total requirements, but Mongolian production covers another 25%. Although it appears that the Soviet Union could make the Eastern Block self-sufficient in fluorspar by the year 2000, concentration on higher-priority commodities coupled with political considerations more likely will lead to a doubling of ocean-borne imports to 600,000 tons per year.

1. Demand

Fluorspar, the commercial term for the mineral fluorite (calcium fluoride), is the primary industrial source for fluorine. There are two principal grades -- metallurgical spar (80-85% CaF_2) and acid spar (at least 97% CaF_2). Metallurgical spar (metspar) in the form of small lumps and briquetted fines is used as a flux in the production of iron and steel. Acid spar, typically recovered as a finely-ground powder by froth flotation techniques, is treated chemically to produce hydrofluoric acid which is the starting point for fluorine-containing chemicals such as synthetic cryolite used in the electrolyte for the production of aluminum and fluorocarbons used in refrigeration and air-conditioning, and for aerosol propellants. Ceramic grade spar (85-96% CaF_2) is an intermediate grade that is produced from ores that would be difficult to beneficiate to acid spar.

In the United States, the only country for which an end use breakdown for fluorspar is available, steelmaking accounts for 50% of all the fluorspar consumed. Production of primary aluminum accounts for 21%, refrigeration and air-conditioning for 6%, aerosols for 11%, and other uses for 12%. The consumption of fluorspar in the Eastern Bloc countries is even more heavily oriented toward production of steel and aluminum than in the United States since the consumer-oriented applications that are important in the major Western nations have not been developed to nearly the same degree. For example, all the Eastern Bloc countries together produce only 7% as many aerosol containers as the United States and in these countries a refrigerator, not to mention an air-conditioner, is still a luxury item for many families. Thus, it is reasonable to assume that at least 90% of the fluorspar consumed in the Eastern Bloc goes to the steel and aluminum industries. To project future demand for fluorspar in the Eastern Bloc, it is necessary to consider these end uses separately and, in the case of steel, to examine what steelmaking methods will be employed.

There are three principal methods for making steel -- open hearth, basic oxygen furnace (BOF) and electric furnace -- each of which requires different fluorspar additions. In the United States at present

fluorspar additions to the open hearth average about 8 pounds per ton while the BOF requires about 10 pounds per ton and the electric furnace about 6 pounds per ton.

These averages disguise the very wide difference in the fluorspar additions actually utilized by various producers. For instance, some open hearths are being operated with only 0.6 pound per ton of fluorspar while over 6 pounds per ton is being added to others. The range is even greater in the case of BOF's -- from 0 to 25 pounds per ton -- and in electric furnaces it is 2 to 44 pounds per ton. Although these wide ranges include differences in the type of steel being produced and the other fluxes being used, principally they reflect the ability and desire of particular furnace operators to use fluorspar.

Fluorspar additions facilitate the steelmaking operation by increasing the fluidity of the slag and reducing the time required for refining. However, large quantities are not necessary if the furnace is being operated by a highly experienced operator. On the other hand, an inexperienced operator tends to utilize more fluorspar because, by doing so, he is more likely to produce a satisfactory heat. Consequently, one would expect that over the years there would be gradual changes in the fluorspar requirements per ton of steel produced in the various types of furnaces as the nature of the industry changed and, in fact, this has been the case both in the United States and elsewhere. Table V-7 shows both the absolute level of consumption and the trends in usage over the past decade in the United States.

TABLE V-7

CONSUMPTION OF FLUORSPAR BY THE U.S. STEEL INDUSTRY

(pounds fluorspar per short ton of steel ingot produced)

Year	Open Hearth	Basic Oxygen Furnace	Electric Furnace
1965	3.4	12.2	7.8
1970	4.0	11.7	8.6
1975	8.0	9.8	6.2

An upward trend has been evident in fluorspar requirements for the open hearth while consumption in BOF furnaces has been decreasing and consumption in electric furnaces has exhibited no real trend. However, more important than these individual trends is the switch away from the open hearth toward BOF units. Because the BOF used more than twice as much fluorspar as the open hearth, this switch has increased average fluorspar consumption in the United States steel industry from 5.4 pounds per ton of steel produced in 1966 to 8.8 pounds per ton in 1975.

Although the Eastern Bloc nations are well behind the West in utilizing the BOF, most of the new capacity under construction (as in other countries) is in BOF's and by the late 1970's the Soviet Union alone is expected to have as much BOF capacity as the United States. Table V-8 lists the BOF facilities existing and under construction in the Eastern Bloc.

Even though open hearth furnaces still make up most of the steel capacity in the Eastern Bloc, consumption of fluorspar is almost twice what would be predicted if the specific consumption in these countries were the same as that in the United States. Such high fluorspar consumption is not a result of any basic technical differences; rather it is due primarily to a difference in the way the steelmaking furnaces are operated. With this much room for improvement, particularly in view of the increasing use of computers in steelmaking, and with such a heavy dependence of the Eastern Bloc on fluorspar imports, we expect that improved steelmaking practice will substantially reduce the specific fluorspar demand. Offsetting this improvement will be increased requirements due to the growing importance of BOF capacity.

Crude steel production in the Eastern Bloc has grown at a rate of 4.1% per year over the past decade, but over the next 25 years it is more likely to increase at about 2.5% per year resulting in total fluorspar requirements increasing by about 60%.

Several fluorine-containing materials are used in the electrolytic reduction of aluminum -- aluminum fluoride (AlF_3), synthetic cryolite (Na_3AlF_6) and fluorite (CaF_2). The principal component of the electrolyte is synthetic cryolite. Aluminum fluoride is added to lower the melting point of the electrolyte but, since it also lowers the electrical conductivity, additions are limited to 5-7%. Fluorspar is used to further reduce the melting point but, again, additions must be limited because fluorite raises the density of the electrolyte and too much would impair the separation of the molten aluminum from the electrolyte. Acid-grade fluorspar is virtually the only raw material used by the aluminum industry since production of both synthetic cryolite and aluminum fluoride starts with hydrofluoric acid.

In the United States, about 125 pounds of fluorspar are consumed per ton of aluminum produced while in the Eastern Bloc consumption is estimated at 180 pounds per ton. Over the next five years, increased cell efficiencies and improved fluorine recovery are expected to reduce specific fluorspar requirements in U.S. aluminum facilities by about 20%. Consumption in Eastern Bloc countries is expected to drop to around 100 pounds per ton, but not until the end of this century. As a result, although aluminum production in the Eastern Bloc is expected to almost triple over the next 25 years, fluorspar consumption in this application will increase only 60%.

TABLE V-8

BASIC OXYGEN FURNACES INSTALLED AND UNDER CONSTRUCTION IN THE EASTERN BLOC NATIONS

Company	Location	No. of Converters Output Per Heat (tons raw steel)	Startup Date	Annual Capacity (million metric tons) existing	planned
		SOVIET UNION			
Met Zavod Imeni Petrovskogo	Dnepropetrovsk (Ukraine)	3 x 50	1967/68	.8	
Met Zavod Krivorizhstal	Krivoy-Rog (Ukraine)	3 x 100	1958	1.8	
		3 x 130	1965/71	2.6	
Yenakiyevskiy Met Zavod	Yenakiyevo (Ukraine)	3 x 130	1968/69	2.6	
Zhdanovskiy Met Zavod Illyich	Zhdanov (Ukraine)	3 x 110	1964/65	2.0	
		1 x 250		2.0	
Azovstal Zavod	Zhdanov (Ukraine)	2 x 350			3.5
Met Zavod Imeni Dzerzhinsk	Dzerzhinsk (Ukraine)	2 x 450			4.0
Makeyevskiy Met Zavod Imeni Kirova	Kirov (Ukraine)	2 x 270		3.0	
Cherepovetskiy Met Zavod	Cherepovets (Central Russia)	2 x 400			4.0
Novolipetskiy Met Zavod	Lipetsk (Central Russia)	3 x 160	1966	3.5	
		3 x 300	1974/78	3.0	3.0
Magnitogorskiy Metallurgicheskiy Kombinat	Magnitogorsk (Urals)	3 x 350			7.0
Novo-Tagilskiy Met Zavod	Nizhniy-Tagil (Urals)	3 x 100	1963/67	2.0	
		2 x 300			3.0
Chelyabinskiy Met Zavod	Chelyabinsk (Urals)	3 x 125	1969	2.2	
West Siberian Steel Works	Antonovskays (W. Siberia)	3 x 130	1969	2.2	
		3 x 300	1973/77	3.0	3.0
		2 x 270			2.7
Kuznetskiy Met Kombinat	Novokuznetsk (W. Siberia)	2 x 300			3.0
Eastern Siberian Works	Svobodnii (E. Siberia)	2 x 300			3.0
Karagandinskiy Met Zavod	Karaganda (Kazakhstan)	3 x 250	1970/72	4.5	
		3 x 250			4.5
		3 x 300		5.0	
Kazakhskiy Met Zavod	Temir-Tau (Kazakhstan)	2 x 350			3.5
			TOTAL	40.20	44.20
		CZECHOSLOVAKIA			
East Slovak Iron & Steel Works	Kosice	3 x 110	1966/67/80	2.2	.8
		2 x 150	1974	2.5	
			TOTAL	3.7	.8
		ROMANIA			
The Integrated Iron & Steel Works	Galati	3 x 150	1968/69	3.5	
		3 x 150	1975	3.5	
		3 x 150	1979/80		
			TOTAL	7.0	3.5
		BULGARIA			
Kremikovtsi Iron & Steel Works	Kremikovtsi	3 x 100	1966	1.7	
			TOTAL	1.7	
		HUNGARY			
Danube Works/Dunai Vasmii	Dunaujvaros	2 x 110	1979		1.1
			TOTAL		1.1
		POLAND			
Huta im. Lenina	Krakow	3 x 120	1966/71	3.5	
Huta Centrum	Katowice	2 x 350	1976/79	4.5	4.0
			TOTAL	8.0	4.0

Because of the potential danger from fluorcarbons in the atmosphere, the outlook for fluorspar demand in the West is very much an open question at this time. The most likely outcome in the near term will be a major reduction in fluorcarbon demand resulting in a slight reduction in total fluorspar requirements. However, even if the Eastern Bloc follows the same course it would not reduce its fluorspar demand significantly because, as noted earlier, fluorcarbons are not an important portion of the market there.

Overall, therefore, the consumption of fluorspar in the Eastern Bloc is expected to rise to about 1.9 million tons by 2000.

2. Production

Of the Eastern Bloc countries, the Soviet Union is the largest producer of fluorspar with production concentrated in Central Asia, Eastern Siberia and the Soviet Far East. Most authorities report that the Soviet Union has 13-14 million tons of fluorspar reserves while production is about 450,000 tons per year, slightly less than one-half of total current Soviet requirements. Output is split about evenly between metspar and acid spar.

Eastern Siberia was the center of early production, with the fluorspar being shipped 2,500 miles west to Sverdlovsk in the Urals for production of synthetic cryolite and other fluorine-base chemicals. The largest of the Eastern Siberian mining areas is Kalanguy, where an underground mine has been in operation since the 1920's. Other mines that have been developed in this region in more recent years include underground operations at Abaguytuy, Usugli and an open pit at Solonechnyy. In 1968 another mine was opened some 400 miles to the west at Khoronkhoy, just north of the Mongolian border. Plans were for this mine to produce 30,000 tons of fluorspar per year initially and then to double or triple production in the early 1970's.

In Central Asia there are three producing regions to the south and southeast of Tashkent -- Toytepa, Khaydarken and Takob -- all of which have been developed since World War II.

In the Soviet Far East fluorspar is recovered at the Yaroslavskiy Mining Combine located at Voznesenka, about 75 miles north of Vladivostok. Here, an open pit operation and concentrator began operating in 1963-64 to produce concentrate that is shipped west on the Trans-Siberian Railway to consumers in the Urals and Siberia. The first section of a new facility, which is to cost 1.2 billion rubles, was commissioned here in 1974 and will process 345,000 tons of ore per year. In addition, newly-found fluorspar reserves in the Transbaykal region are claimed to total 45 million tons, while for the past 15 years consideration has been given to exploitation of a significant fluorspar deposit in the Ukraine, although so far no decision has been made.

Some fluorine also is recovered as a by-product from processing apatite from the Kola Peninsula which reduces the overall requirements for fluorspar. Recovery of fluorine from the Karatau phosphate rock deposit in Kazakhstan (see VI-B-1), where concentrates average about 2.7% fluorine, and from the newly-discovered phosphate rock deposit at Seligdar in Eastern Siberia would supply much of the Eastern Bloc requirements. However, it is unlikely that a high rate of fluorine recovery will be achieved so fluorspar imports will still be important to the economies of the Eastern Bloc nations at the end of this century.

In the late 1960's there was a report that a cryolite deposit was being opened up near Lake Baykal and that a mine-mill complex capable of producing up to 20,000 tons of cryolite concentrate per year was under construction. If true, this complex would decrease annual import requirements for acid-grade fluorspar by 25,000 tons per year.

Mongolia is the other principal CMEA fluorspar producer, with production of metspar having risen from a level of 75,000-90,000 tons per year during the late 1960's to 240,000 tons per year since 1973. East German fluorspar production of about 90,000 tons per year is obtained from deposits in the Harz Mountains, the Thuringian Forest and Saxony. About 20,000 tons per year of acid-grade fluorspar are produced; the other 70,000 tons are primarily metspar. Czechoslovakia also produces about 90,000 tons per year of fluorspar, most of which comes from a half-dozen mines in Bohemia. One-half of this production is acid-grade fluorspar, the other half is metallurgical grade, making Czechoslovakia essentially self-sufficient. Bulgaria produces an estimated 20,000 tons per year and Romania 15,000 tons per year of metspar while Hungary and Poland apparently have no production. Romania recently has installed facilities to produce aluminum fluoride and synthetic cryolite from waste fluosilicic acid, thereby reducing her demand for fluorspar.

We estimate that total production in the Eastern Bloc (principally in the Soviet Union) will increase by 50%, which will require imports (in addition to those from Mongolia) of 600,000 tons of fluorspar in 2000.

3. Import Potential

Imports to the Soviet Union in 1975 totalled 493,900 tons of fluorspar, of which 301,800 tons came from Mongolia, 55,400 tons from China, and 58,500 tons from Thailand. The remaining 78,000 tons came probably from Spain, Brazil, Italy, North Korea and East Germany.

East Germany supplies most of the Eastern Europe fluorspar requirements, although in 1974 Poland also imported 18,200 tons from China and 9,000 tons from North Korea. In addition, a few thousand tons are imported from various West European countries.

It would appear that the Soviet Union has enough known fluorspar reserves to make the Eastern Bloc self-sufficient by the end of the century. However, since the total import volume is not particularly large and there are several fluorite-exporting countries with which the Soviet Union has or may have political ties, it seems most likely that the Eastern Bloc will still be a major net fluorspar importer in 2000.

Mongolia, in spite of reportedly limited reserves, is expected to continue to be an important source. It is difficult to conceive that Mongolian production would have been expanded to the degree it has been recently without reserves to back it up, so it would appear that reserves have been located but not reported. Thailand and China, the other two major traditional sources, will likely continue to be important, although competition for fluorspar from these sources will increase as world demand rises.

Kenya, where fluorspar production started only in 1969, is expected soon to have capacity for 200,000 tons of acid-spar and metspar. The Soviet Union utilized 11,000 tons of this spar in 1974 and substantial imports from this source in the future are expected (although no imports were reported from Kenya in 1975).

South Africa claims about one-third of total fluorspar reserves and so would be a likely source for any importing nation. Deposits in South Africa have not yet been developed to the same degree as in other countries and the extent to which South Africa becomes a supplier of fluorspar to the Eastern Bloc depends on the rate of this development as well as on political alliances.

It is also likely that Mexico, assuming that it continues to pursue its economic ties with the Soviet Union, very likely will become a significant supplier of fluorspar to the Eastern Bloc, probably replacing Brazil and some of the West European suppliers. With larger production than any other country in the world (Mexico accounts for 25% of total world production), imports of Mexican fluorspar would be a natural method by which the Soviet Union could lend ecoromic support to this country. For the same reason Italy, with reserves not far behind those of Mexico, also could become an important source.

All of the water-borne Soviet fluorspar imports of which we are aware have come into ports on the Black Sea. Internal CMEA trade would be overland while imports to Poland would be into the Baltic Sea.

Destination/Source	Central America	Africa	Southeast Asia	Western Europe
Black Sea	150	225	25	30
Baltic Sea	10	20	10	5
Pacific Coast	--	25	100	--

D. FERROALLOYING ELEMENTS

Except for tungsten, the Soviet Union has adequate resources of ferroalloying elements to supply its own requirements and the needs of Eastern Europe as well. The Soviet Union is a major exporter of manganese, chromium and nickel to the West. At present, some molybdenum is imported but the shortage is believed to be a short-term one that should be alleviated in a few years when mine construction already under way is completed. The Soviet Union's concerted efforts to become self-sufficient in tungsten are expected to succeed, but Eastern Europe will likely continue to depend on overseas sources for much of its tungsten requirements.

1. Manganese

While the Eastern Bloc is a major net exporter of manganese, oceanborne bulk cargo is involved in some of the intra-Bloc trade.

Manganese ore is composed of manganese dioxide mixed with various impurities. There are three distinct grades of manganese ore -- metallurgical, chemical and battery -- depending on the end use for which it is appropriate. Metallurgical ore is by far the most important, accounting for well over 95% of all manganese ore consumed in the Soviet Union and Eastern Europe.

The Soviet Union consumes more manganese ore per ton of steel produced than any other major country -- over 2.5 times the rate of consumption in the United States. The Soviet Union is not alone in this regard; East European countries also tend to use manganese at a disproportionately high rate. The rate of consumption is dropping, however. In the period 1955-1970, consumption was reduced from 170 pounds per short ton to 95 pounds per ton (which may be compared to U.S. consumption of 37 pounds per ton in 1970). This high consumption has been attributed to a combination of factors -- the low manganese content of Soviet iron ores, the high sulfur content of Soviet coking coal, and a greater use of high-manganese steels -- while the decline has been credited to the increased use of natural gas in Soviet blast furnaces.

Whether these factors are the complete explanation is not too important since the Soviet Union is the only major industrialized nation to be self-sufficient in manganese. In fact, the Soviet Union accounts for about 40% of total world manganese ore production. It also supplies most of the manganese ore Eastern Europe requires, although in some years India has supplied ore to some of these countries. Hungary, Czechoslovakia, Romania and Bulgaria also produce manganese ore, but Hungary is the only one to satisfy its own requirements. In addition, Soviet manganese ore is exported to non-Communist nations, principally Western Europe, Canada and Japan.

Soviet manganese ore reserves are second only to those of South Africa and are more than adequate to support the expected increase in steel production and continue to export major tonnages to Eastern and Western Europe. However, export tonnages will not increase as rapidly as demand because of an expected trend towards exporting ferromanganese rather than manganese ore. For example, as a first step in expanding its ferromanganese production, the Soviet Union is planning to install eight new 72,000-KVA furnaces at its Nikopol' ferromanganese complex, raising the capacity of that facility in 1980 to 1 million tons per year of ferromanganese.

About 95% of the Soviet reserves of manganese are located in just two groups of deposits -- in the Nikopol' district in the Ukraine and at Chiatura in the Caucasus. The Nikopol' deposits, located near the iron ore region of Krivoy Rog, supply two-thirds of the Soviet manganese ore. The Chiatura deposits, where annual production of run-of-mine ore exceeds 6 million tons, account for one-third. Small manganese deposits in the Urals (Polunochnoye) and Kazakhstan (Dzhezdy) now are insignificant producers, although they were key sources during World War II when the Ukrainian mines were occupied by the Germans.

Out of total exports of 1.5 million tons of manganese ore in recent years, the Soviet Union has shipped about 1.1 million tons of ore and ferromanganese to Eastern Europe (Table V-9).

TABLE V-9

REPORTED SOVIET EXPORTS OF MANGANESE TO EASTERN EUROPE

(thousand tons)

	1966	1970	1971	1972	1973	1974	1975
Manganese Ore							
Bulgaria	--	80	110	103	108	130	126
Czechoslovakia	149	153	252	265	331	329	341
East Germany	198	175	193	172	165	150	179
Poland	317	365	360	417	465	495	484
Ferromanganese							
Hungary	13	13	20	17	18	19	22
Romania	24	34	33	38	36	37	39

Source: Vneshnyaya Torgovlya SSSR

In the present analysis ocean-borne exports destined for Western Europe are not of interest; those bound for Eastern Europe are. In general, manganese ore destined for Bulgaria and Czechoslovakia is shipped by

rail from the Nikopol' deposits (which also constitute the principal source of manganese for the Soviet steel industry); the ore exported to Poland and East Germany -- a total of about 650,000 tons per year for the years 1973-1975 -- comes from the Chiatura deposit. This ore, destined for ports on the Baltic Sea, is loaded on ships at the Black Sea port of Poti. Ferromanganese would be shipped by rail.

With steel production in Poland and East Germany expected to increase at about 2.5% per year, and assuming a reasonable reduction in the specific consumption of manganese ore, this trade should be maintained at about 700,000 tons.

Starting in 1977, a new shipping service opened from the Sea of Azov via inland waterways to Leningrad and thence on the Baltic Sea to the East German port of Stralsund. Open from April through October, in its first year of operation this route is expected to carry 100,000 tons of manganese ore to East Germany. By the year 2000, we assume this route may carry one-half of the manganese ore shipped from Poti to East Germany and Poland. In an emergency, the Chiatura ore could be transported by rail to Poland and East Germany, but this undoubtedly would be quite disruptive because of the substantial tonnages and long distances involved.

2. Chromium

As the world's largest chrome ore producer, the Soviet Union is in an excellent position not only to supply the needs of Eastern Europe, but also to export considerable quantities to the United States, Western Europe and Japan.

Chrome ore is composed of chromite ($FeCr_2O_4$) plus various impurities. There are three distinct grades of chrome ore -- metallurgical, refractory and chemical. Users of metallurgical and chemical ore are primarily interested in how much chromium they can extract from the ore, although in metallurgical applications the physical structure is also important. Users of refractory ore are principally concerned about the chemical behavior and physical structure of the ore.

The principal use for chromium is as an alloying element to impart corrosion resistance to stainless steel. In fact, in the United States this application accounts for 75% of all chromium consumed in direct metallurgical applications. In the Soviet Union, the percentage probably is even higher because of the much more limited availability of stainless steel scrap which supplies one-third of the chromium required by the U.S. producers of stainless steel. Chromium is also a critical constituent of many alloy steels and certain high-temperature alloys. Most stainless and other steels have military as well as commercial applications.

Chromite refractories are used primarily to line open-hearth steelmaking furnaces. Although the basic oxygen furnace (BOF) is becomming the principal method of making steel throughout the world, open-hearth furnaces still account for two-thirds of the steel produced in the Soviet Union and Eastern Europe.

Chemical-grade chromite is used to produce chrome plating chemicals, chrome pigments and sodium bichromate for leather tanning. Most applications for chrome chemicals are not critical, although hard chrome plating often is used to surface critical, high-wear machine parts. In the United States, chemical-grade chromite ore accounts for about 20% of total chromite consumption.

The Eastern Bloc consumes a relatively large amount of chrome ore, particularly considering that production of stainless steel is less important in these countries than in the United States. Part of the explanation for this is that the BOF has not been adopted as rapidly as in the West. Since chromite refractories are used in open-hearth furnaces, but so far to only a very limited extent in the BOF, countries that are still primarily dependent on open hearths require more refractory grade chromite[1]. In addition, chromium has long been used in these countries as a substitute for nickel, which was very short during World War II and subsequently, although the nickel shortage has been alleviated and the Soviet Union now even exports considerable nickel, it is difficult to switch producers and consumers away from traditional grades.

The Soviet Union is the world's largest chrome ore producer and, in spite of the rapid growth in world demand, actually has increased its share from 30% of the total in 1960 to 40% today, while tripling production from 1.2 million metric tons in 1960 to 3.5 million tons in 1975. South Africa is the second most important producer, currently accounting for about 20% of world production while Albania is third with 8% (much of which goes to Czechoslovakia). As with manganese, the Soviet Union is self-sufficient in chrome ore and supplies both ore and ferrochrome to her East European satellites, none of which have any domestic production. About 15% of Soviet exports of chrome are to Eastern Europe while 85% are to Western steel producers. Recent exports to Eastern Europe are given in Table V-10.

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1. The role of the BOF in Eastern Bloc steel production is discussed in Section V-C.

TABLE V-10

REPORTED SOVIET EXPORTS OF CHROME TO EASTERN EUROPE

(thousand tons)

	1966	1970	1971	1972	1973	1974	1975
Chrome Ore							
Czechoslovakia	49	89	106	97	104	107	131
East Germany	24	25	36	45	31	30	40
Hungary	9	13	21	17	10	18	17
Poland	67	76	105	118	121	125	109
Ferrochrome							
Hungary	5.4	7.4	7.7	3.8	5.8	6.4	6.6
Romania	5.7	9.2	9.8	9.7	8.2	7.6	7.5

Source: Vneshnyaya Torgovlya SSSR

There are two principal chromite producing areas in the Soviet Union, both in the Urals. The older of the two is at Sarny, in the northern Urals, where most of the ore is low grade and suitable only for refractory and chemical applications. Exploitation of the Khromtau (chrome mountain) deposit in the southern Urals, which yields high-grade chrome ore suitable for metallurgical applications, started during World War II. Much of this ore is converted nearby at Aktyubinsk into various grades of ferrochrome.

There are indications that the Soviet Union increasingly will favor exports of ferrochrome in place of the chrome ore now exported. Ferroalloys, particularly ferrochrome, potentially offer a very attractive method to increase the value added to Soviet exports to the industrialized nations of the West. Utilizing vast, low-cost Siberian hydroelectric resources to produce various ferroalloys would not only significantly increase the value added to manganese and chrome exports, but also would effectively export a renewable resource -- hydroelectric power -- which is available in remote geographical locations. With development of the Baykal-Amur Mainline link with the Pacific Coast, the physical movement of such commodities across the Soviet Union will be greatly facilitated. In fact, Moscow plans to phase out exports of high-grade ore by the end of 1980 and to consume its entire production of high-grade chrome ore in the production of ferrochrome. The Soviet Union has negotiated with U.S., West European and Japanese firms about constructing ferrochrome facilities in the Soviet Union, with repayments to be made in exports of ferrochrome. Not only would exports of ferrochrome increase the value added by the Soviet Union, but transportation costs would drop about in half. Several East European countries already export ferrochrome, particularly Czechoslovakia and Hungary, although Poland and Bulgaria are also significant.

Considering the location of the principal Soviet chromite deposits, it is most likely that the bulk of the chromite or ferrochrome that is exported to Eastern Europe is shipped by rail.

3. Nickel

The Soviet Union is exploiting the world's largest copper-nickel sulfide deposit -- larger even than Canada's Sudbury deposit. The output from the Talnakh deposit, located near Noril'sk in Eastern Siberia, recently has enabled the Soviet Union to become an exporter of significant quantities of nickel, not only to Eastern Europe, but also to the West. The principal use for nickel in the Eastern Bloc, as in the West, is in the production of stainless steel and high temperature alloys.

While Poland and East Germany have minor mine production of nickel (each about 2,500 tons per year), Cuba is the other major source of nickel for the Eastern Bloc. At present 30% of the nickel oxide output from Cuba's Nicaro facility and all of the nickel sulfide output from its Moa Bay facility are sold to the Eastern Bloc. Cuba's exports of nickel to the Eastern Bloc in 1972 are detailed in Table V-11.

TABLE V-11

EXPORTS OF NICKEL FROM CUBA TO THE EASTERN BLOC

(tons)

	Nickel Sulfide		Nickel Oxide	
Destination	Nickel Content[a]	Gross Weight[b]	Nickel Content[a]	Gross Weight[c]
Soviet Union	18,095	32,600	--	--
Czechoslovakia	648	1,170	2,595	3,350
Hungary	--	--	670	860
Poland	--	--	529	680
East Germany	458	830	430	560
Romania	--	--	200	260

[a]Also contains cobalt

[b]Estimated at 55.5% nickel

[c]Estimated at 77.5% nickel

Sources: American Metal Market and Arthur D. Little, Inc., estimates

The nickel sulfide from the Moa Bay plant is shipped presumably to the Black Sea and then by rail to its final destination at Buruktal', 100 miles east of Orsk in the southern Urals. The Moa Bay facility, as it was designed by Freeport Sulphur Company, utilized a special purpose tanker which was employed to transport the sulfide slurry from Moa Bay to Port Nickel near New Orleans, and return with raw materials used in the process. The vessel, which was to make a round trip in 12 days, was equipped with rubber-lined tanks that accommodated 2,800 tons of sulfide slurry on the northbound leg; on the southbound leg it carried 5,800 tons of molten sulfur in insulated tanks and 140 tons of liquid petroleum gas in cylindrical deck tanks. The sulfur was used to manufacture hydrogen sulfide and sulfuric acid for the process. When Cuba nationalized the Moa Bay facility and looked to the Soviet Union as its source of raw materials, this arrangement was abandoned. Now dry sulfide concentrate is shipped to the Soviet Union; solid sulfur, hydrogen sulfide and fuel oil are backhauled.

Cuban nickel production is scheduled to increase dramatically over the next 15 years. The first phase of this expansion, which already is under way and will be completed in the early 1980's, consists of raising the capacity of the Nicaro facility from 18,000 tons per year of contained nickel in nickel-cobalt oxide to 22,500 tons per year. The Moa Bay facility, which produces 18,000 tons per year of contained nickel in nickel-cobalt sulfide will be increased to 24,000 tons per year.

The second phase, also currently under way, is to construct a 30,000-ton-per-year oxide plant at Punta Gorda, two miles east of Moa Bay, and another 30,000-ton-per-year oxide plant five miles east of Moa Bay. The Soviet Union is financing the first facility, which should be ready in the early 1980's, while CMEA will finance the second, which is to come on stream in the mid-1980's. Subsequently, either one or two more oxide plants will be built in the Moa Bay area, raising annual capacity to 150,000-200,000 tons of nickel in nickel-cobalt oxide.

The goal expressed by the Cubans is to market its increased nickel output 50% to the West and 50% to the Eastern Bloc. The Cubans also claim they will continue to receive preferential prices from Eastern Bloc customers. In 1973, for example, the Soviet Union purchased sulfide concentrate from Cuba at $2.27 per pound of contained nickel. Although the 4% cobalt content of this concentrate adds to its value[2], this does not come close to justifying such a price when refined nickel was selling for $1.53 per pound.

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2. In 1973 refined cobalt sold in the West for about $3 per pound.

Although the Soviet Union certainly will be able to supply total Eastern Bloc nickel requirements through the remainder of this century, Cuba will continue to market its product to East European countries thereby freeing up more material for Soviet hard currency exports. Total 1975 nickel consumption in Eastern Europe is estimated at 33,000 tons, an increase over 1972 which averaged about 11% per year. Assuming demand increases to around 80,000 tons per year and that domestic production in Eastern Europe can be maintained at about the current level of 5,000 tons per year, Cuba could supply 75,000 tons of nickel as oxide (100,000 tons gross weight). Three-quarters of this will go into the Baltic and one-quarter into the Black Sea. In addition, presumably 45,000 tons of sulfide, containing 24,000 tons of nickel, will be shipped to the Black Sea destined ultimately for Buruktal'.

4. Molybdenum

Although the Soviet Union is a major producer of molybdenum, at present there is a shortage because several projects have not progressed as rapidly as planned. However, Soviet reserves of molybdenum are third behind those of the United States and Chile, and the Eastern Bloc should be independent of the outside sources for molybdenum when the construction programs now under way in the Soviet Union and Mongolia have been completed.

Molybdenum is a critical element in the production of certain high-performance grades of alloy steel. It is widely utilized in the United States both because the United States produces 60% of the total world molybdenum output and because molybdenum-containing steels are used extensively in automobiles.

The Soviet Union consumes only about 20% as much molybdenum per pound of total steel produced as does the United States. Thus, although Soviet consumption of molybdenum will increase more rapidly than the steel industry as a whole, it is not expected to approach the high consumption levels of the United States. However, Eastern Bloc molybdenum demand is expected to more than double in the next 25 years.

The Soviet Union is the principal molybdenum producer in the Eastern Bloc, with output in 1975 estimated at 10,500 tons of molybdenum in concentrates. Bulgaria is the only other producer, with an output estimated at 640 tons per year.

There is a dearth of information on molybdenum trade in Eastern Bloc countries. Exports from Western sources consist of only a few hundred tons per year of ferromolybdenum into each of several East European countries -- not enough to supply the demand in these countries. The Soviet Union does not report exports and none of the East European countries reports imports from the Soviet Union, but the inevitable conclusion is that the Soviet Union is in fact supplying the bulk of East European molybdenum requirements.

Production of molybdenum extends along the southern border of the Soviet Union from Tyrnyauz in the Caucasus to Davenda and Vershion-Shakhmatinskiy 400 miles east of Lake Baykal. The largest single source of molybdenum is the Kadzharan copper-molybdenum deposit in Armenia which accounts for 20% of total Soviet output. Copper-molybdenum ores account for 50% of Soviet output, 30% is attributed to molybdenite ores and 20% to tungsten-molybdenum ores. There are over a dozen producers of molybdenum concentrate, several of which are undergoing expansion or renovation and several deposits are being developed. In particular, the Sorskiy copper-molybdenum deposit, located 400 km northeast of Krasnoyarsk, will be expanded from its present level of 8 million tons per year to 14 million tons in the early 1980's. With ore grading 0.025% molybdenum, this will produce over 3,000 tons per year of molybdenum.

In addition, the Soviet Union is financing the development in Mongolia of what reportedly could be one of the world's major copper deposits. (See Section V-J-1.) No indication of the molybdenum grade of the Erdenet deposit[3] has been made public, but it is presented as a copper-molybdenum deposit and is expected to become a major source of molybdenum for the Eastern Bloc.

On the other hand, it seems unlikely that the massive Udokan copper deposit[3] will be an important future molybdenum source. Again, no ore analysis is available but Udokan is referred to as a copper deposit, not a copper-molybdenum deposit, and the processes being considered by Soviet metallurgists for recovering the copper suggest that molybdenum is not present in recoverable amounts.

Considering the relatively modest increase expected in molybdenum demand, Soviet and Mongolian sources should be adequate to satisfy requirements. If they prove to be inadequate, the most likely sources normally would be the United States, Chile or Canada. However, the few thousand tons involved would not likely constitute bulk cargoes and, if NATO sources were denied, molybdenum could be airlifted from Chile, Peru and China.

5. Tungsten

The Eastern Bloc is not self-sufficient in tungsten; the Soviet Union produces only two-thirds of its own tungsten requirements (one-half of total Eastern Bloc requirements) and no other Eastern Bloc country is a significant source.

As in the West, China for many years was the principal source for the requirements not covered by Soviet production. In the mid-1970's, however, China was reluctant to continue to supply the world with tungsten at what it considered low prices, forcing Western and Eastern Bloc consumers alike to look to other sources.

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3. These deposits are discussed further in Section V-J-1.

Used in tungsten carbide metal cutting tools, tool steels and as a critical constituent of high-temperature alloys, tungsten is an essential material for any industrialized society. However, none of the major industrial nations is self-sufficient in tungsten. Before the mid-1960's, China, with half of both reserves and total world production, was the preeminent source of tungsten for the world. However, Chinese production dropped from 30,000 tons of concentrate in 1960 to 17,600 tons in 1965, where it has remained, and China now accounts for only around one-fourth of total world output and exports have dropped to 8,000-9,000 tons per year of concentrate. Other countries which have significantly increased production over the past 15 years to take up the slack left by China include Thailand, Bolivia, Peru, Australia, Canada and Japan.

Production in the Soviet Union has risen steadily from 11,000 tons of tungsten concentrate in 1960 to 17,000 tons in 1975. In fact, today Soviet output of tungsten concentrate may well exceed that of China. Soviet production of tungsten is derived from tungsten-molybdenum ores located in the south and from tungsten-tin ores found in the northeast. The largest producers of tungsten concentrates are the Trynyauz tungsten-molybdenum mines in the Caucasus, which are being expanded. The Ingichka concentrator in Uzbekistan, one of the largest in the Soviet tungsten industry, came on stream in 1973 and has capacity to handle 25% more ore than is currently available to it. The Inkur open pit and the concentrating facility at the Dzhida tungsten-molybdenum complex, located on the Mongolian border just south of Lake Baykal, are expanding production while a concentrator to serve the Vostok-2 tungsten mine, located 250 miles north of Vladivostok, is under construction. In Eastern Europe, about 80 tons per year of tungsten are recovered from the tin-tungsten ores of the Cinevec and Horni Slavkov districts of Czechoslovakia and production here is expected to increase in the future.

The 1976-80 five-year plan calls for increased emphasis on developing additional tungsten resources. As a result, a number of tungsten deposits are being explored. Tungsten discoveries in Kazakhstan have been listed among the most important in the Soviet Union while other important discoveries of tungsten have been reported in the Far East, including some adjacent to the Vostok-2 Combine. It is impossible to tell at this time how successful the Soviet drive toward self-sufficiency in tungsten will be, although it seems more likely than not to succeed as far as domestic Soviet demand is concerned based on the large geologically-promising areas in Siberia that have not yet been adequately explored. However, to satisfy total Eastern Bloc requirements, Soviet production would have to almost quadruple from its present level, which seems unlikely. Thus, Eastern Europe is expected to continue to be dependent on sources such as China, North Korea, South Korea, Thailand, Canada and Bolivia. Because of increasing Soviet self-sufficiency, however, total Eastern Bloc imports, which are currently equivalent to about 20,000 tons per year of tungsten concentrate, probably will not exceed 25,000 tons per year of tungsten concentrate by the year 2000. About 80% of the tungsten concentrate will be shipped into the Baltic and 20% into the Black Sea. Although these will not be bulk shipments, they will be semi-bulk and quite essential.

E. TIN

Although the Soviet Union is second only to Malaysia in the mine production of tin, imports still account for 30% of Soviet tin requirements and 90% of East European tin consumption. While development of tin production in the Soviet Union will continue to receive relatively high priority, it is unlikely this will result in complete Soviet self-sufficiency, let alone self-sufficiency for the Eastern Bloc as a whole and, by the year 2000, tin imports are expected to reach 30,000 tons.

In the past decade, the consumption of tin has stagnated or declined in most industrialized countries, primarily because of the use of thinner coatings of tin in the production of tinplate and the increasing utilization of blackplate (which uses no tin) and aluminum for cans. Since tinplate is the principal market for tin in Western countries (30% of consumption in the United States, 40% of U.K. consumption, and over 50% of French consumption), whatever happens in this market has a significant effect on the total demand for tin.

Considering all applications except tinplate, the per capita consumption of tin in the Soviet Union (0.24 pound per person) already is slightly above that of France (0.22 pound) and two-thirds that in the United States (0.35 pound) and the United Kingdom (0.31 pound). On the other hand, Soviet consumption of tin for production of tinplate (0.066 pound per person) is one-half that of the United States (0.13 pound), one-third that of the United Kingdom (0.20 pound) and one-quarter that of France (0.24 pound). If Soviet industry utilized electrolytic tinning lines more extensively,[4] its consumption of tin for tinplate would be even lower -- probably 0.02-0.03 pound per capita. The low Soviet requirements for tinplate are due to the rudimentary nature of the Soviet food processing industry, the extensive use of glass jars, and probably also to the high cost of tinplate due to the inefficient use of tin in tinplate production. However, since all new tinplate facilities constructed in the Soviet Union employ electrolytic tinning lines, much of the growth in tinplate production will not be translated into increased demand for tin.

It would seem reasonable to assume that by the year 2000, Soviet per-capita-tin consumption could reach 0.44 pound -- 0.14 pound for tinplate and 0.30 pound for all other applications. This would increase total tin consumption at that time to 60,000 tons per year.

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4. Hot dipping, a method long abandoned in the West but still utilized for two-thirds of Soviet tinplate production, requires up to three times as much tin per unit of surface area as electrolytic tinning.

Current consumption of tin in Eastern Europe totals 13,000 tons or 0.26 pound per person for all applications. Consumption may be expected to increase to 0.40 pound per capita over the next 25 years, giving a total tin consumption of 22,000 tons per year by 2000.

Soviet tin production in 1975 is estimated to have been 25,000 tons. Tin is recovered from about a dozen locations, all of which are in Eastern Siberia. Unlike the other important tin producers, most of the tin in the Soviet Union is derived from lode deposits, although several placer deposits are worked. A placer deposit in the Laptev Sea (72°N) was worked on an experimental basis during the summer of 1976, but it is claimed that year-round operation is required for this deposit to be exploited economically and the feasibility of accomplishing this has yet to be proved. Deposits discovered some time ago in Magadan and Yakutia have yet to be developed, presumably because of the high costs, but several new tin deposits discovered farther south presumably will be exploited. With the deposits already under developments, Soviet tin production is expected to rise to 35,000 tons by 1980 and will probably reach 50,000 tons by 2000. This would leave 10,000 tons per year to be imported at the end of the century, about the same as was required in 1975.

East Germany currently mines about 1,100 tons per year of tin from the Harz Mountains while Czechoslovakia recovers perhaps 100 tons per year from the tin-tungsten ore mined in the Cinovec and Horni Slavkov Districts. Thus, over 90% of the tin consumed in Eastern Europe must be imported. Assuming East European production can be maintained, by the year 2000 imports of 21,000 tons of tin will be required.

The sources of tin imports into the Soviet Union are shown in Table V-12.

TABLE V-12

SOVIET TIN IMPORTS

(tons)

	1965	1970	1975
Malaysia	1,600	2,622	5,161
Bolivia (metal)	--	302	1,720
(concentrate)[a]	--	716	234
United Kingdom	2,200	4,942	2,697
Indonesia	1,400	--	--
China	500	200	--
Other	100	234	76
TOTAL	5,800	9,016	9,888

[a]Estimated tin content.

Source: Vneshnyaya Torgovlya SSSR

The Soviet Union is giving aid to the Bolivian tin industry and is being repaid with tin concentrate and metal. Eastern Europe depends to a much greater extent than the Soviet Union on the United Kingdom for its tungsten requirements while China also is an important source, particularly for Romania.

For the year 2000 we have assumed the following ocean-borne trade pattern for tin imports into the Eastern Bloc (in tons):

Source/Destination	Baltic Sea	Black Sea
Southeast Asia	11,000	8,000
Pacific Coast South America	2,000	2,000
Western Europe	5,000	3,000

F. BARITE

The European Bloc, particularly the Soviet Union, is a net importer of barite and imports are expected to increase somewhat as oil and gas drilling activity increases.

By far the principal use for barite is as a weighting agent in oil- and gas-well drilling muds. As deeper wells are drilled in the Soviet Union (see Section III-B) the need for a weighting agent will increase substantially. Alternative weighting agents such as iron ore and Fer-O-Bar can be employed but, considering the cost and effectiveness of the materials available, the tendency will be to use barite.

The Soviet Union produces about 400,000 tons per year of barite, which satisfies 60% of present domestic demand. The remainder is imported from Bulgaria, Yugoslavia and North Korea.

East European requirements could be completely satisfied by its own production since imports from Western Europe are more than offset by exports to Western Europe. However, present Soviet requirements could not be met within the Eastern Bloc. Bulgaria has extensive reserves of barite and exports about 85,000 tons per year to the Soviet Union. Although Romania probably produces more than 100,000 tons per year of barite, and exports much of its output to Western Europe, it no longer supplies significant quantities to the Soviet Union. This may change in the future as the large deposits recently discovered in Romania are exploited. Poland, with production of 80,000 tons per year, is now just about self-sufficient.

The main centers of Soviet production are Georgia, Western Siberia, and Kazakhstan. Development of additional barite deposits in these areas is proceeding and deposits are known in other regions. However, the relatively low grade of most Soviet barite and the long transportation distances involved apparently have resulted in the decision to depend on imports to a significant extent.

Future consumption of barite in the Soviet Union will depend primarily on increased oil and gas drilling activity. Consumption of barite in the United States currently is running about 1.8 million tons per year while Soviet consumption is 650,000 tons per year. It is not unreasonable to expect Soviet demand in the year 2000 to equal current U.S. consumption, or almost triple present demand.

While the Soviet Union probably could become self-sufficient in barite production, it is doubtful this will happen. Imports from Eastern Europe, Yugoslavia and North Korea into the regions that can be more directly served from these sources than from domestic sources probably will continue for a combination of reasons that include minimizing transportation costs, trade and political considerations, and the use of barite in barter arrangements to minimize Soviet investment and to provide economic support to North Korea. As oil and gas drilling activity increases in Eastern Siberia, it is likely that barite deposits will be found in this area and will be developed. However, it still is expected that 150,000 tons per year of North Korean barite will continue to be imported by ship into the Pacific Coast while 350,000 tons per year will be imported by rail from Eastern Europe and Yugoslavia.

G. MICA

The Soviet Union is self-sufficient in scrap and flake mica, a relatively non-essential mineral used principally as an inert filler in certain paints and construction materials. Sheet mica, which is used as a critical insulator in many electronic and electrical applications, is another story. Soviet imports of 500 tons per year of sheet mica virtually all come from India. All of the East European countries likewise import their sheet mica requirements, and also their scrap and flake mica, from India. Total imports of mica into the Eastern Bloc from India have averaged 5,000 tons in recent years, but only 2,000 tons of this is sheet mica.

The demand for sheet mica is expected to decline gradually over the next 25 years as new insulating materials are developed which can be substituted for mica. By the year 2000, the demand for sheet mica in the Eastern Bloc is projected to drop to 1,000 tons per year, with India continuing to dominate as a supplier.

The Soviet Union, which already produces over 40,000 tons per year of flake mica, is expanding existing capacity and developing a new production center. There are adequate reserves of mica to enable the Soviet Union to remain self-sufficient and, if it wished, to supply Eastern Europe. However, there appears to be no attempt to cover these requirements and imports of scrap and flake mica into Eastern Europe may well increase. Since this material is used for non-critical applications, its disruption would not seriously affect economic activity.

H. MAGNESITE

The Soviet Union produces 1.7 million tons per year of marketable magnesite while Czechoslavakia produces 600,000 tons per year. While these countries are among the important producers of the world, nevertheless, the Eastern Bloc (specifically, the Soviet Union and Poland) still imported about 500,000 tons of magnesite in 1975, almost all from North Korea. Magnesite, which is used principally as a refractory in the steel industry, is widely available throughout the world. A very large, high-grade magnesite deposit, with reserves estimated at 2 billion tons, is under development in Eastern Siberia near Lake Baykal and could make the Eastern Bloc more than self-sufficient. However, North Korea, which produces 1.5 million tons per year of magnesite, will probably continue to supply 500,000 tons per year to the Eastern Bloc to help offset imports from that area. Of the total, it is estimated that 20% will go to the Baltic and 80% to the Black Sea.

I. TALC

The Soviet Union produces about 440,000 tons per year of talc, about 7% of world production, and Bulgaria is not far behind. Romania and Hungary also are important East European producers, but imports of around 100,000 tons are still required to satisfy total Eastern Bloc demand. Soviet production will continue to increase gradually, but imports will likely continue to be required.

Talc is widely used as an inert filler or carrier in products such as paints, paper coatings, insecticides and rubber products. About 90% of Soviet talc production is low-grade material and it is likely that Soviet imports, which reached 90,000 tons in 1975, were of high-grade quality grades. The principal source of Eastern Bloc imports has been North Korea, with the Soviet Union alone receiving 60,000 tons from this source in 1975. We expect imports of North Korean talc to reach 200,000 tons by the year 2000, 75% to the Black Sea and 25% to the Baltic Sea.

J. COMMENTS ON OTHER METALS

Included in this section are comments on several metals which, for one reason or another, do not fall strictly within the scope of this study, but that should be considered in the context of the goal of self-sufficiency within the Eastern Bloc.

1. Copper

Before the mid-1960's, the Soviet Union depended to a relatively minor degree on imports of copper. Since then, however, development of copper deposits in both the Soviet Union and in Poland have made the Eastern Bloc a major exporter of copper. And, assuming development of the massive Udokan deposit in the 1980's, the Eastern Bloc will be able to maintain its export position through this century.

The principal applications for copper generally involve its use as an electrical conductor -- e.g., for motor windings, telephone and power lines, in electronic components and for a wide range of other electrical products. Such applications account for about 60% of total U.S. consumption of primary copper and undoubtedly a significantly greater percentage of Eastern Bloc consumption. The other major market for copper is in the production of brass. Although many materials can be substituted for copper and brass in specific applications, as a practical matter where copper still is used today it is because it offers certain technical advantages that make substitution by other materials difficult or uneconomic.

Over the past ten years, consumption of copper in the Soviet Union has grown at an average of 4.4% per year while consumption in Eastern Europe has grown at 6.0% per year. Over the next 25 years these growth rates are expected to decline gradually, while at the same time they generally will follow the overall trend in GNP.

The Soviet Union, with mine production of about 1.1 million tons per year of copper, is by far the most important source of copper in the Eastern Bloc. In fact, it is second only to the United States in world production. Poland, with production of 230,000 tons and Bulgaria and Romania, with around 50,000 tons each, are also important suppliers. Czechoslovakia, East Germany, Hungary and Romania combined mine about 22,000 tons per year.

Until the mid-1960's, the Soviet Union imported copper from the West and exported about the same amount to its Communist allies. After 1963, imports virtually disappeared and exports to the West, which began in 1966, increased rapidly, reaching 243,000 tons by 1974. The Eastern Bloc presently is more than self-sufficient in copper. Although there still are some imports from the West, these are more than offset by exports to the West. The principal Eastern Bloc imports of copper materials from the West in 1973 were:

Destination	Origin	Commodity	Contained Copper (tons)
Czechoslovakia	Austria	Concentrate	5,800
East Germany	Sweden	Concentrate	17,700
Soviet Union	Chile	Concentrate	19,000
Soviet Union	Chile	Metal	6,100
Poland	United Kingdom	Metal	14,400
Romania	Chile	Metal	5,300
Romania	United Kingdom	Metal	7,900

In recent years the Soviet Union has exported around 100,000 tons of copper and copper products to the West, with another 100,000-150,000 tons per year going to Eastern Europe. Typically it has imported about 15,000 tons per year. In 1970 Poland had net copper imports of about 4,000 tons, but discovery of a new deposit in Poland resulted in exports of around 50,000 tons to the West in 1975. Poland agreed at the end of 1976 to export 40,000 tons per year of copper to West Germany through 1988. Even Czechoslovakia, East Germany and Hungary export certain copper products to the West.

Since 1965 refined copper production in the Soviet Union has grown at about 6% per year, reaching 1.3 million tons in 1975. Between 1975 and 1980 production is planned to increase another 20-30%, continuing this growth rate.

This growth rate will come principally from expansion and improvements in existing facilities. The major expansion currently under way is in Noril'sk (the Nadezhda Metallurgical Plant) where capacity for smelting 650,000 tons of copper concentrates containing 200,000 tons of copper is being added. Three of the four mines that will supply ore for this smelter are already in production; the initial shaft for the fourth mine is being sunk this summer. In the 1980's the Udokan deposit in Eastern Siberia also will likely be developed. This deposit has been the subject of numerous discussions between Soviet authorities and Western mining companies in an attempt to have them help the Soviet Union develop this deposit, but the Soviets apparently have been able to elicit no real interest. However, the Baykal-Amur Mainline currently under construction will greatly facilitate access to this area and recent quarry operations at the Udokan deposit probably are designed to yield samples with which to develop the process flow sheet and pilot plant test program. Plans are to develop this deposit over the next 15 years at a cost of around 2 billion rubles, including building a city for 70,000 inhabitants.

The Udokan deposit is claimed to have reserves totalling 1.2 billion tons of ore. It contains an average of 1.15% copper, 20% in the form of oxides, and 80% as sulfides. Exploitation will be by open pit at the rate of 30 million tons per year of ore to produce 350,000 tons of copper. Thus, this deposit alone will yield one-third of current Soviet mine output of copper. Coupled with expansions in existing copper facilities and other new copper deposits that will be opened up over the next 25 years, it is reasonable to assume that the Soviet Union will become a major exporter of copper by the end of this century, continuing to supply not only any requirements of Eastern Europe, but also those of Western consumers including Japan (by shipments through Pacific Coast ports). In addition, the Soviet Union is helping Mongolia develop the Erdenet copper-molybdenum deposit which contains about 3 million tons of copper.

Poland also is expanding its output of refined copper. Based on the major high-grade deposits (2% copper) discovered in the Lubin-Glogow

basin in 1957, Polish refined copper output has risen rapidly in recent years. Production in 1970 was about 70,000 tons, rising to 250,000 tons in 1976 and a planned 420,000 tons in 1980. To expand its output, Romania is developing very low-grade copper deposits (Moldova Nouva with 0.23% copper and Rosia Poienii with 0.3% copper). Bulgaria's copper output also is based largely on low-grade ore, principally the 0.36% copper (0.008% molybdenum) Medit open-pit operation.

Some imports of copper concentrate and metal undoubtedly will continue to come into those countries in Eastern Europe which do not have adequate copper mine production. Others, particularly the Soviet Union, probably will continue to import copper in various forms from countries such as Chile with which they have political ties and from other Western nations with which they maintain normal trade relations. However, the Eastern Bloc will be a net exporter of copper and the transportation of copper metal to any member of the Eastern Bloc could be handled easily on overland transportation systems, making such imports unessential in terms of the present analysis.

2. Lead and Zinc

The Soviet Union, with smelter production of over 550,000 tons per year of lead, produces nearly as much as the United States, the world's leading producer. Soviet zinc production of over 800,000 tons per year is the largest in the world, twice that of the United States. All of the East European countries also mine lead and zinc, with Bulgaria (110,000 tons of lead and 85,000 tons of zinc), Poland (75,000 tons of lead and 240,000 tons of zinc) and Romania (45,000 tons of lead and 55,000 tons of zinc) being the most important. Although the Soviet Union is more than self-sufficient in both lead and zinc, with net exports of about 20,000 tons of lead and 125,000 tons of zinc, the Eastern Bloc as a whole has net imports of around 35,000 tons of lead, but is self-sufficient in zinc. Future production increases in the Soviet Union and Poland are expected to reduce the dependency on lead imports and could make the Eastern Bloc a net exporter of zinc.

The principal Soviet lead-zinc mining area is in Kazakhstan which reportedly contains about 12 million tons of lead and 15 million tons of zinc, over two-thirds of total Soviet lead-zinc reserves. In recent years, mine expansion in Kazakhstan and in other areas of the Soviet Union has not progressed as rapidly as planned, but there is little question that exploitation of known deposits over the next 25 years could raise lead and zinc production to supply any reasonable growth in demand.

Output from all East European countries has increased over the years and is expected to continue to increase gradually. In particular, Poland's new Pomorzany mine near Olkusz will dramatically increase output from that country in the near future. This mine, which will have an output of 2.1 million tons per year of lead-zinc ore, started production in 1974 and will raise Polish output by 1980 to 120,000 tons

per year of lead and 260,000 tons of zinc. By the year 2000, it is expected that lead imports will be less than 5% of Eastern Bloc consumption while the Eastern Bloc probably will be a net exporter of zinc.

3. Titanium

The Soviet Union is the world's largest producer of titanium and exports major quantities to the other important producing countries of Western Europe, Japan and the United States. Utilizing relatively plentiful ilmenite rather than scarce rutile, which is required by Western producers, the Soviet Union continues to increase its titanium production capacity both to serve its internal military requirements and as a source of hard currency.

Titanium is used extensively in aerospace applications, particularly in jet aircraft structural parts and engines. Although the Soviet titanium metal industry developed relatively late, because of these critical aerospace applications it has received high priority. In fact, since the mid-1960's there has been considerable excess production which led to exports to the West and fostered the early and extensive use of titanium chemical process equipment in the Soviet Union. As a result, the Soviet Union probably has a higher specific consumption of titanium in its chemical process and metallurgical industries than any other country. At the same time it has become an important supplier of titanium to the West. Soviet production in 1975 reached 36,000 tons while U.S. production at that time was only 14,000 tons. And a 40% increase in Soviet capacity is planned between 1975 and 1980. There are more than adequate ilmenite reserves to maintain production at whatever level is desired.

4. Cobalt

Although cobalt was exported from the Soviet Union in the early 1960's. in recent years demand has exceeded supply. As a result, the Soviet Union has maximized domestic production of cobalt, often at the expense of co-product production and in 1975 Soviet production of cobalt reached 5,000 tons. In the future, increasing production of cobalt from the Talnakh copper-nickel deposit will greatly increase output and should allow the Soviet Union not only to supply Eastern Europe but also to resume exports of cobalt to the West.

5. Others

The Soviet Union is one of the major world producers of platinum, palladium, mercury, magnesium, vanadium and cadmium. Production of these metals is and will continue to be sufficient not only to supply East European requirements, but also to export significant quantities to the West to earn hard currency. Of course, gold also falls into this category. However, since the industrial applications for gold are minor compared to its use as a means of generating hard currency, the domestic requirements for gold also were included in Table II-7 in Section II-F.

K. COMMENTS ON OTHER NONMETALLIC MINERALS

The Soviet Union and Eastern Europe are self-sufficient in most of the other nonmetallic minerals. Except in a few cases, however, the governments involved, particularly the Soviet government, have not spent the same effort on developing these resources as they have on developing metallic resources. Therefore, some nonmetallic minerals for which the Eastern Bloc has adequate reserves have not been developed to the full extent possible. Also, the Soviet Union does not dominate Eastern Bloc production of nonmetallic minerals to the same extent that it does the production of metallic ores.

This situation has occurred because nonmetallic minerals tend to be low-valued, bulk materials, many of which are utilized primarily as construction materials and as fillers. On the other hand, metals tend to be high-valued products that are essential to the development of industrial and military products. Because of their scarcity, the metals and their ores also usually are traded around the world; nonmetallic minerals, the deposits of which usually are much more widely available, typically are not important articles of international commerce. In this section we have reviewed the more important nonmetallic minerals not already discussed in order to provide the reader with a balanced view of the resource base of the Eastern Bloc.

1. Asbestos

The Soviet Union is the largest producer of asbestos in the world, with current production of about 2.3 million tons. Except for minor output from Bulgaria, there is no asbestos production in Eastern Europe and all requirements must be imported. The Soviet Union supplies 200,000 tons to East European consumers which is equal to about 75% of their total requirements. The Soviet Union also exports 350,000 tons to the West, more than enough to satisfy total East European requirements if necessary.

Four asbestos mining areas are producing in the Soviet Union, and several of these are being expanded. However, the most important development is taking place at a fifth deposit located near the Kiyembay in the southern Urals. Development of this deposit was begun in 1968 and is expected to be complete in the early 1980's. Under an agreement signed in 1973, all six East European countries are investing in this project[5] and will share in the 500,000-ton-per-year output in proportion to their contribution. This is one of the several joint investment projects developed under CMEA's Comprehensive Program and calls for the investment of over 100 million transferable rubles. In exchange, the Soviet Union will supply an equivalent value of asbestos to each participant over the period

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5. For example, Czechoslovakia will supply dump trucks and other equipment.

1979-91, with provisions to extend the agreement another ten years to 2001. The breakdown of investments and the tonnage of asbestos to be received annually are as follows:

	Equivalent Investment (million rubles)	Annual Asbestos Receipts (thousand tons)
Bulgaria	24.0	40
Czechoslovakia	8.4	14
East Germany	24.0	40
Hungary	1.8	3
Poland	30.8	50
Romania	18.0	30
TOTAL	106.2	177

The Kiyembay deposit is large, with an estimated 20 million tons of asbestos reserves. An open pit 2.2 km long and 1.8 km wide is being developed which will produce 24 million tons per year of ore. With completion of the Kiyembay development, the asbestos requirements of the East European countries will be satisfied for some time and it is assumed that imports from North America and Africa will cease.

The Soviet Union already consumes about the same amount of asbestos as the United States and demand is expected to grow at a relatively modest rate over the next 25 years. The known Soviet asbestos deposits are expected to be adequate to supply this growth in both the Soviet Union and Eastern Europe without the need for imports.

2. Sulfur

The Eastern Bloc is self-sufficient in sulfur. Although the Soviet Union has large reserves of sulfur and produces about 9 million tons per year, it imported nearly 700,000 tons in 1975, virtually all of which came from Poland. Exports totalled 440,000 tons, primarily to Cuba, Czechoslovakia and Hungary. However, if Soviet exports of 1.6 million tons of pyrite (principally to West Germany, Italy, Czechoslovakia and Yugoslavia) and 200,000 tons of sulfuric acid (to Czechoslovakia and East Germany) are included, it is evident that sulfur is actually in oversupply in the Soviet Union. Soviet sulfur production is expected to reach 11 million tons per year by 1980.

Poland is the other major Eastern Bloc supplier of sulfur, producing 5 million tons with all but about 1 million tons going to both Eastern and Western Europe.

No basic shortage of sulfur is foreseen in the Eastern Bloc through the remainder of this century.

3. Salt

The Eastern Bloc is self-sufficient in salt. The Soviet Union is the world's third largest producer of salt, the raw material for the production of chlorine and caustic soda. With annual Soviet production of 14 million tons augmented by 4 million tons in Poland, 4 million tons in Romania and 2 million in East Germany, there is adequate salt to supply Czechoslovakia, Bulgaria and Hungary, and still export around 300,000 tons to Western Europe.

No problem is foreseen with the Eastern Bloc maintaining self-sufficiency in its salt requirements through the remainder of this century and probably moderate amounts will continue to be exported.

4. Clay

There is considerable trade in various types of clay and refractory products, both among the Eastern Bloc nations and with Western Europe. However, very little of this trade moves by bulk ocean transportation and inaccessibility to ocean-borne imports would not cause a major disruption of industrial activity.

5. Others

The Eastern Bloc is self-sufficient in gypsum, with up to 100,000 tons per year being exported to Western Europe. The Soviet Union is a major producer and exporter of flake graphite, and industrial and gem diamonds, covering not only the requirements of Eastern Europe, but also exporting considerable amounts of each to the West.

VI. OTHER PRODUCTS

A. FERTILIZERS

The Eastern Bloc is a major producer and exporter of both potash and phosphate rock. While potash will continue to be exported, the reserves of phosphate rock are such that the Eastern Bloc will become a major importer of phosphate materials in the near future with imports rising to 27 million tons per year by the end of the century.

1. Phosphate

With 23% of total output, the Soviet Union long has been the world's second largest producer of phosphate rock behind the United States. In the past, the Soviet Union has produced enough phosphate not only to supply East European requirements (there is no East European production), but also to export considerable quantities to Western Europe. Demand grew so fast, however, that in the early 1970's the Soviet Union put the East European countries on notice that they would have to look increasingly to other sources for their phosphate requirements in the future. The Eastern Bloc already is a net importer of phosphate materials and, even assuming development of considerable additional domestic reserves, by the year 2000 still will have to import the equivalent of 33 million tons of phosphate rock.

As discussed under agricultural products (see Chapter IV), the application of fertilizer in the Soviet Union and Eastern Europe is receiving high priority in each country's effort to improve its agricultural output. As a result, consumption of phosphate in the European Bloc is expected to increase at about 6% per year until 1980, and then drop to 5% per year for the rest of the century. This growth will raise the demand for phosphate rock equivalents[1] from the present level of 24 million tons to 86 million tons in the year 2000. This projected growth in consumption is the same as is derived by considering the five-year plans of the individual Eastern Bloc countries (see Figure IV-2), and we believe it is both a reasonable and technically achievable goal.

The current sources of phosphate rock for the Eastern Bloc are shown in Table VI-1. Of the 9.36 million tons of rock imported by individual Eastern Bloc countries, 3.7 million tons came from the Soviet Union and

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1. The various grades of phosphate materials involved have been normalized to phosphate rock equivalents; i.e., that amount of phosphate rock (containing 32% P_2O_5) which would contain an equal amount of P_2O_5.

5.66 million tons came from other sources. In addition to the 3.7 million tons exported to other Eastern Bloc countries, the Soviet Union exported another 1.8 million tons to various West European countries. If internal production capacity cannot be increased significantly, exports to Western Europe will probably disappear first followed by a reduction in exports to the other countries in the Eastern Bloc. Finally, as internal demand continues to increase in the Soviet Union, rock imports will be required to satisfy domestic Soviet demand.

Table VI-1 also sets forth a supply scenario which assumes only the relatively little additional expansion in phosphate rock production from deposits currently being worked in the Soviet Union and the resulting need for very large volumes of imported rock. The problem is where all this rock will come from for it is evident that the threat of the very large import volume indicated in Table VI-1 will exert considerable pressure to develop new deposits.

TABLE VI-1

EASTERN BLOC PHOSPHATE SUPPLY-DEMAND

(thousand tons of phosphate rock equivalents)

	1975	1980	1985	2000
Demand				
Soviet Union	14,797	19,800	25,300	52,600
Eastern Europe	9,356	12,522	15,980	33,200
TOTAL DEMAND	24,153	32,322	41,280	85,800
Supply				
Soviet Union	18,497	22,400	24,700	27,300
Imports	5,656	9,922	16,580	58,500
	24,153	32,322	41,280	85,800
Soviet Markets				
Domestic Consumption	14,797	19,800	24,700	27,300
Eastern Europe	3,700	2,600	--	--
Western Europe	1,777	--	--	--
	20,274	22,400	24,700	27,300

Sources: British Sulphur Corp., Ltd., and Arthur D. Little, Inc., estimates

Since they began operating in the 1930's, the Kola apatite mines have met the bulk of the phosphate demands from the Eastern Bloc superphosphate manufacturers while the relatively small amount of phosphate rock produced by other mines in European Russia has been used for direct application of ground phosphate rock and in a few special situations. The 1975 production target for Kola was 15.3 million tons of apatite concentrate (18.7 million

tons of rock equivalent[2]) compared to 11.3 million tons in 1970. A further increase to 18 million tons of concentrate is planned for 1980 and reports indicate that ultimately production can be raised to 20-24 million tons per year of concentrate (24-29 million tons of rock equivalent).

Several low-grade phosphate rock deposits are being exploited in European Russia, but they have been utilized principally as ground phosphate rock which is applied directly to the soil. Because the phosphate in ground rock phosphate is released only very slowly, and therefore is not immediately available to crops, the trend is away from direct application in favor of prepared fertilizers, although current research is directed at proving that over the long term, results with ground phosphate rock are comparable with those obtained using superphosphate. In fact, from 1970 through 1975, there was no growth in Soviet production of ground rock phosphate while the output of total phosphate rock increased 46%.

The other important phosphate-producing area in the Soviet Union today is located in the Karatau region of Kazakhstan in Central Asia. Phosphate rock was discovered here in the mid-1930's, but there was little interest in exploiting the deposit at that time because the first Kola apatite mine had just been developed and the Soviet Union had consequently become self-sufficient in rock supplies for its fertilizer plants, all of which were located in European Russia. However, during World War II, the Soviet superphosphate industry had to be moved to Central Asia, initially utilizing plants evacuated from European Russia, and the Karatau deposit was mined to provide raw material for these facilities.

Recently, exploitation of the Karatau deposit has been increasing rapidly, rising from 5 million tons in 1971 to over 10 million tons in 1975. However, the deposit is in a relatively remote region, which complicated its early development. When this deposit was first discovered, it was evident that relatively high-grade ore suitable for direct use in fertilizer manufacture constituted only a small portion of the 1.2 billion tons of reserves at Karatau. This ore is being utilized only by the few superphosphate plants in the immediate area. Attempts to upgrade the lower-grade ores have failed because of the very low yields that have been achieved. The alternative chosen was to produce elemental phosphorus from the low-grade ore. However, not only is production of this product costly, but also it does not appear to be compatible with the objective of expanding shipments of fertilizer to European Russia and, in fact, it has been criticized in the Soviet press.

In the early 1970's, reports indicated that the technical problems encountered in using low-grade Karatau phosphate rock for the production of wet process phosphoric acid, followed by production of monoammonium

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2. Kola apatite concentrate contains 38.5-39.5% P_2O_5.

phosphate, were being solved. Further progress is indicated by the announcement that Karatau rock is the raw material for the first superphosphoric acid plant built in the Soviet Union which came on stream early in 1976. With a capacity of 60,000 tons per year, it will be operated to provide data for the design of additional superphosphoric acid plants in the area.

Another deposit of phosphate rock recently has been discovered near Aldan in Eastern Siberia, 250 miles north of the Baykal-Amur Mainline (BAM) which is now under construction. According to preliminary estimates, apatite reserves here amount to 3 billion tons of high-grade ore and this could well prove to be the principal deposit to help satisfy the growing Soviet phosphate requirements after the mid-1980's. Preliminary plans are to exploit this deposit at the rate of 60 million tons per year.

Finally, development already is underway to exploit the relatively low-grade Oshurkov apatite deposit located just south of Lake Baykal in Eastern Siberia. The 1.2-million-ton-per-year pilot concentrating mill being constructed here is expected to start up during 1978 and will be used to carry out tests over the next four years. If it develops the Karatau, Aldan, Oshurkov and yet-to-be-discovered Soviet phosphate deposits, the Soviet phosphate rock industry could reasonably expect to increase output from its present level of 20 million tons of rock equivalent to 52 million tons in the year 2000. This would leave 33 million tons to come from imports since economic phosphate deposits are not expected to be found in any of the East European countries.

The Soviets recognized some years ago that they would not be able to develop major new phosphate deposits rapidly enough to satisfy Soviet phosphate rock requirements. Consequently, they advised the East European countries to seek other sources and made arrangements to cover their own increasing demand.

Eastern Europe is looking to North Africa to meet its needs and long-term agreements have been made. Romania has been particularly active, assisting Syria in the development of phosphate mining and extraction, the building of storage and loading facilities and the construction of a superphosphate plant. Romania also has participated in the construction of a phosphate ore facility in Egypt and has assisted in a mining project in Tunisia. Czechoslovakia is assisting Egypt in exploiting phosphate rock deposits and will receive crude oil and phosphate rock in exchange for a loan covering the purchase of Czechoslovakian equipment. Bulgaria has granted credits, assisted in the development of phosphate rock deposits, and provided mining equipment and ore dressing facilities in Tunisia and Syria. Recently, it agreed to provide credits to the Congo for the establishment of a joint company for development of phosphate and other mineral deposits. To assure phosphate rock for the recently-completed fertilizer plant at Petfurdo, Hungary has signed a six-year agreement to import phosphate rock from Morocco starting with 135,000 tons in 1975 and increasing to 230,000 tons per year thereafter.

At one time it was thought that the Soviet Union might receive substantial tonnages of elemental phosphorus in return for financing the construction of a phosphorus complex at Aswan, Egypt, but this project never got beyond the protocol stage. In addition, the exploration of Iraq's phosphate resources has been carried out with Soviet assistance, but the amount of rock available from this source over the long term would not be great.

The most widely publicized agreement is the one signed with Occidental Petroleum whereby Occidental supplies 1 million tons per year of P_2O_5, probably in the form of superphosphoric acid, for a period of ten years which may be extended for an additional ten years if both parties agree at the time. In exchange, the Soviet Union will supply ammonia, urea and potash. Shipping terminals for this trade are being constructed at Ventspils on the Baltic and at Grigoryevskiy (Odessa) on the Black Sea.

In recent years, Western Europe also has supplied significant quantities of superphosphate, with payment often made with potash.

Another source of Soviet phosphate imports will be Morocco, most likely in the form of phosphate rock. The agreement signed with Morocco calls for the Soviet Union to supply Morocco with plant and equipment for a new phosphate complex to exploit the Meskalas deposit. This deposit initially will be mined at a rate of 3 million tons per year, which will be increased to 10 million tons per year. The Soviets are asking for 3 to 5 million tons per year of phosphate rock in the 1980's and 10 million tons per year after 1990. In return, Morocco will receive sulfur, potash and other fertilizer materials, crude oil, mine timbers, etc., from the Soviet Union. Thus, of the 33-million-ton deficit, 13 million tons are already arranged for -- 10 million tons of rock to come from Morocco and 3 million tons of rock equivalent (1 million tons of P_2O_5) to come from the United States in the form of 1.4 tons of superphosphoric acid (70% P_2O_5). Most of the remaining 20 million tons will most likely come primarily from the Spanish Sahara and Morocco -- the only countries known to have massive reserves of phosphate rock. Small quantities -- probably on the order of 500,000 tons of rock equivalent each -- also will come into Eastern Europe from Tunisa, Egypt, Syria and the Congo.

Since consumers would prefer to buy rock and rock producers would prefer to sell phosphate fertilizer, shipments will be partly as phospate rock and partly as phosphate fertilizer, most likely triple superphosphate (46% P_2O_5). We have assumed that by the year 2000, trade with Africa (all of which will be ocean-borne) will be split evenly between the two products (on a P_2O_5 basis) -- 15 million tons of rock and 10.5 million tons of triple superphosphate. With an additional 1.4 million tons of superphosphoric acid coming from the United States, total trade in phosphate materials is projected to reach 27 million tons by the end of the century.

Table VI-2 shows the pattern of seaborne trade in phosphate rock in 1973. About 70% of the rock went to the Baltic Sea while 30% went to Black Sea ports.

TABLE VI-2

SEABORNE TRADE IN PHOSPHATE ROCK - 1973

(thousand tons)

Source/Destination	Baltic Sea	Black Sea	Total
United States	113	134	247
Morocco	1,734	524	2,258
Tunisia/Algeria	653	216	869
Israel/Jordan/ Syria/Egypt	45	200	245
TOTAL	2,545	1,074	3,619

Source: H. P. Drewry, Ltd.

In 1973 all rock imports were destined for Eastern Europe, but in the future, the trade pattern will change considerably as the Soviet Union becomes a major importer. While the Occidental superphosphoric acid will be imported into both the Baltic and Black Seas, it is expected that the Black Sea will predominate in the Soviet receipts of rock from Morocco and the Spanish Sahara as it will in the East European receipts from North Africa, Syria and the Congo. We have assumed that by the year 2000 the Black Sea will handle about 70% of the imports and the Baltic Sea 30%. Most of this trade probably will be carried in vessels of up to 30,000 dwt.

2. Potash

The Soviet Union and East Germany are respectively the first and third producers of potash in the world -- with production of 8 and 3 million tons of K_2O[3] in 1975. Between them, they supply all of the Eastern Bloc potash requirements and export 1.7 million tons to the West. Potash reserves are extensive and production is increasing in both countries, but particularly in the Soviet Union. Over the next 25 years, potash is expected to continue to be a major Eastern Bloc export.

Based on the planned increases in fertilizer application rates in each of the Eastern Bloc nations through 1990 (see Figure IV-2) and reasonable extrapolations of the application rates from 1990 through 2000, the consumption of potash in the Eastern Bloc is expected to triple between 1975 and 2000. While satisfying this demand will require major expansions in production capacity, particularly in the Soviet Union, the known raw

3. Soviet data usually is reported in terms of "standard potash fertilizer" which contain 41.6% K_2O.

materials base is sufficient to support such an increase and new deposits are being explored in Poland and the Soviet Union that, if developed, would facilitate both the expansion and the transportation of the product to the farms.

The principal centers of potash production in the Soviet Union are the Uralkali Combine located in the Kama River valley north of Perm to the west of the Ural Mountains and the Beloruskali Combine located in central Belorussia about 180 miles from the Polish border. Together these combines account for about 90% of total Soviet potash production with the remainder produced in the Western Ukraine.

The deposits in the Urals supplied all the Soviet potash until after World War II when, with the annexation of the East Galicia portion of Poland, the Soviet Union acquired control over the potash deposits in that region.

With the increasing demand for fertilizers in the late 1950's, the Beloruskali Combine was formed to develop these deposits. The first mine to exploit these deposits came on stream in 1963, and during the remainder of the 1960's attention of the Soviet potash industry was focused on the development of additional mines in this area. However, of the total reported Soviet potash reserves of 22.9 billion tons of 16-40% K_2O content (3.8 billion tons of K_2O), about two-thirds are found in the Ural deposits and during the 1970's attention was redirected back to the Uralkali Combine. Construction is still underway on the two largest operations in the Uralkali Combine. Both will have capacity to produce 2.9 million tons per year of contained K_2O; one is to come on stream by the end of 1977, the second a year later. By 1980 the planned production of the Beloruskali Combine is to be 4.5 million tons per year of K_2O while the Uralkali Combine is to produce 7 million tons.

Development of the potash deposits in the western part of the Ukraine was begun in the 1920's when this region was still part of Poland. Capacity was increased after World War II, but production still amounts to only around 500,000 tons per year of K_2O and this area does not appear scheduled for major expansion in the future.

Other potash deposits can be exploited in the future. Deposits in the southern part of the country near the Caspian Sea and the Afghanistan border are not so well located in relation to those already being exploited. However, exploration near Kaliningrad on the Baltic Sea has found a potash deposit that presumably is an eastward extension of a deposit known in Germany and Poland. This deposit is well located to supply consumers in Northwest European Russia as well as to serve export markets. Exploration is also underway in Poland to develop potash production in that country.

The potash deposits in East Germany are in the southwestern part of the country. There are four separate potash producing regions which, together, will be called upon to produce 3.6 million tons per year of K_2O by 1980, 20% above 1975 production. Although production from some of these deposits can be further increased, it is likely that East German production will not increase as rapidly as East European potash demand over the next 25 years.

B. NATURAL RUBBER

The Eastern Bloc is completely dependent on imports for its supply of natural rubber, as are the other industrialized nations of the world. The Eastern Bloc is minimizing its natural rubber requirements and, by 1985, will consume only one-half as much natural rubber per unit of total rubber consumption as Western nations will require. Imports of natural rubber are expected to continue at around 500,000 tons per year.

The principal application for natural rubber is in truck, bus and automobile tires. A certain portion of most radial tires and both bias and radial truck tires must be natural rubber to achieve desirable properties in the final tire as well as to facilitate tire construction. Natural rubber, with relatively low heat buildup when flexed, is particularly necessary in bias construction heavy truck and off-highway vehicle tires where the thick sidewall section generates less heat in operation than identical tires based on styrene-butadiene rubbers. Natural rubber also is extensively used in both passenger car and truck radial tires where its properties of high tack and high green strength are desirable during the more complex and demanding tire building process.

At the present time in the Eastern Bloc, just over 18% of the total rubber consumed is natural rubber. This is well below the requirements in the United States and only one-half of the proportional European and Japanese requirements. The reduction in Eastern Bloc requirements is relatively new as shown in Table VI-3 and the result of a concerted effort to increase the capacity to produce various types of synthetic rubber.

TABLE VI-3

CONSUMPTION OF NATURAL RUBBER AS A PERCENTAGE OF TOTAL RUBBER CONSUMPTION

(%)

	1965	1970	1975
Eastern Bloc	36.17	30.59	19.19
Total EEC	45.73	37.53	35.92
United States	25.05	22.58	25.93
Japan	53.45	36.33	32.78

Source: The International Rubber Study Group.

The increased reliance on synthetic rubber over the past decade has enabled the Eastern Bloc to hold imports of natural rubber to around 500,000 tons while increasing total rubber consumption from 1.2 million tons in 1965 to 2.6 million tons in 1976. Table VI-4 shows the growth in synthetic rubber production in Eastern Bloc countries since 1965.

TABLE VI-4

PRODUCTION OF SYNTHETIC RUBBER IN THE EASTERN BLOC

(tons)

	1965	1970	1975
USSR	542,500	800,000	1,600,000
Bulgaria	--	3,600	18,900
Czechoslovakia	30,000	49,600	56,700
East Germany	94,800	118,000	143,900
Poland	39,200	61,700	107,900
Romania	30,800	61,200	98,900
TOTAL	737,300	1,093,900	2,023,000

Source: The International Rubber Study Group.

The goal for the 1976-80 Soviet five-year plan is to increase the production of all types of synthetic rubber by about 40%. However, plans are to increase the production of isoprene, the raw material for polyisoprene which is the most closely related substitute for natural rubber, by 75%, underscoring the emphasis that is being placed on minimizing the requirements for natural rubber. Although Western authorities believe the goal for isoprene production will not be achieved quite that rapidly, there is no disagreement about the intentions.

Consumption of rubber in the Eastern Bloc is expected to increase considerably. The per capita consumption of rubber in the Eastern Bloc is about 60% of that in the United States and about 90% of the EEC and Japanese per capita consumption as shown below (in pounds per capita):

United States	26.4
EEC	16.5
Japan	17.3
Eastern Bloc	15.2

Per capita consumption of rubber in the Eastern Bloc will increase over the next 25 years, although it is doubtful that it will rise much above 20 pounds per capita, which is significantly above present EEC consumption. This will mean total consumption of 4 million tons of rubber per year by the year 2000.

There are limits on the extent to which total rubber consumption can increase in the Eastern Bloc without increasing the imports of natural rubber. With present technology, 15% natural rubber is considered the minimum percentage that could be achieved in the West. If this were true in the Eastern Bloc as well, then imports of natural rubber in the year 2000 would reach 600,000 tons. However, efforts will continue to minimize natural rubber imports, and by 2000 it is likely that the percentage of natural rubber required will be further reduced and thereby permit natural rubber imports to be maintained at about 500,000 tons per year or 13% of projected total rubber consumption at that time.

Considering the location of the tire manufacturing facilities in the Soviet Union and the relative importance of rubber production in the various East European countries, it is expected that 40% of the total imports will come into the Baltic while 60% will come into the Black Sea -- virtually all from Malaysia, Indonesia, Thailand and Sri Lanka, which together account for 85% of total world production and virtually all of Eastern Bloc imports.

C. OTHERS

1. Chemicals

The Eastern Bloc is essentially self-sufficient in the important chemical products, except as has been noted in previous sections. An indication of this self-sufficiency is presented in Table VI-5 which compares the Eastern Bloc production of a few selected chemicals in 1975 with production in the United States and the European Economic Community. However, there is considerable trade both among the Eastern Bloc members and with Western Europe. The vast majority of this trade is by rail, and ocean-borne shipments, particularly in bulk, are not significant.

TABLE VI-5

EASTERN BLOC PRODUCTION OF SELECTED CHEMICALS IN 1975

(thousand tons)

	Caustic Soda	Ammonia[a]	Sulfuric Acid	Plastics
Soviet Union	2,396	10,050	18,600	2,840
Bulgaria	84	935	854	156
Czechoslovakia	256	800	1,245	428
East Germany	445	900	1,002	550
Hungary	89	555	650	123
Poland	391	1,752	3,410	433
Romania	478	1,555	1,448	347
Total Eastern Bloc	4,140	16,500	27,200	4,880
United States	8,408	11,775	27,709	11,048
European Economic Community[b]	5,360	7,400	17,600	15,000[c]

a. Nitrogen content.

b. Belgium, Denmark, France, Ireland, Italy, Luxembourg, the Netherlands, the United Kingdom and West Germany.

c. Estimate.

Source: Central Intelligence Agency.

The Soviet Union accounts for about two-thirds of the Eastern Bloc chemical industry. Although production of chemicals was emphasized early in the development of the Soviet heavy industry, the Soviet chemical industry has lagged in the production of products such as man-made fibers and plastics. Not only is output of such products low, but it is technically well behind that of the West. Through the 1950's, furthermore, Soviet plastics production focused on thermosetting resins, primarily phenolics, which could be derived relatively inexpensively from coke chemicals. In contrast, the plastics producing nations of the West, in addition to increasing their output substantially, were shifting to the more useful thermosetting resins. The production of thermoplastics in the Soviet Union did not begin until the early 1960's.

Although the highly developed East German chemicals industry suffered comparatively little wartime damage, it was largely dismantled by the Soviets after World War II because of the potential military applications of many of the chemicals produced. Recovering from this setback, the chemicals industry now accounts for about 20% of East German GNP. Over half of the chemical industry is located in the Halle-Leipzig area. The increasing production of plastics is based on crude petroleum imports through the Friendship pipeline terminating at a large refinery complex at Schwedt on the Oder River. Pipelines carry products and crude from this complex to the Halle-Leipzig area. Plans are also under consideration for a pipeline from an oil terminal at the port of Rostock.

Poland is one of the largest producers of chemicals in Eastern Europe. It is a major producer of sulfur-based chemicals based on deposits in the Tarnobrzeg area. Deposits of salt, barites, anhydrite and potash support other segments of the industry while the large coal deposits are the basis of chemical by-products of coke production. Petrochemical production is based on Soviet crude oil.

The chemicals industry in Czechoslovakia has a critical problem -- water -- which has held back its development. For example, Czechoslovakia's largest chemical works, located at Zaluzhi near Most, obtains its water through a 25-mile pipeline from the Elbe River. In spite of this handicap, the Czech chemicals industry is growing, particularly in Slovakia where water is more available, the rivers are less polluted and the supply of labor is easier.

The Hungarian chemicals industry is small, primarily because of a lack of appropriate raw materials. Manufacture of pharmaceuticals, centered in Budapest, has long been a major segment of the industry. Production of petrochemicals based on crude oil piped from the Soviet Union and plastics which use natural gas piped from Romania also are becoming important.

Romania's chemical industry accounts for over 10% of total industrial output. Sulfuric acid production is based on pyrites and as a by-product of smelting nonferrous metals while the several soda ash plants utilize the large, high-grade salt deposits that occur in several parts of the country. Romania's natural gas and petroleum resources have provided a base for significant production of inorganic chemicals. In Bulgaria the chemicals industry has developed only since World War II, but today accounts for around 7% of total industrial production.

2. Cement

The Eastern Bloc is more than self-sufficient in cement, with Soviet exports to the West alone amounting to about 1.3 million tons per year. There are, however, two significant ocean-borne imports of cement into the Eastern Bloc -- 250,000 tons per year from Sweden into Poland and 500,000 tons per year from North Korea into the Soviet Union. Neither trade can be considered critical since Poland's annual cement production is about 17 million tons while the Soviet Union's production is more than 120 million tons. However, North Korea probably will continue to ship 500,000 tons per year to the Soviet Pacific coast to help pay for imports.

3. Pulp and Paper

The principal shipments of pulp and paper into the Eastern Bloc are from Finland into the Soviet Union. In 1975 the Soviet Union produced 5.2 million tons of paper and imported 240,000 tons of pulp and 480,000 tons of paper, 60% of which (150,000 tons of pulp and 260,000 tons of paper) were from Finland. Exports of pulp, however, were 520,000 tons and of paper were 620,000 tons, making the Soviet Union a net exporter of both pulp and paper. East European imports of pulp and paper, which are much smaller, also are predominantly from Finland and other Scandinavian countries.

4. Machinery and Equipment

Machinery and equipment constitute by far the largest single category of Soviet imports, accounting for about one-third of the total value. Many of these imports, the vast majority of which are destined to be included in the Soviet capital stock, would be considered essential within the context of this study. However, a high percentage of these imports originate in Western Europe and those which come from overseas typically are not handled as bulk or even semi-bulk cargo. Disrupting the supplies of machinery and equipment from the West would inhibit the construction of new production facilities, but probably would have little effect on output in the short term.

VII. SHIPPING, PORTS AND TRADE ROUTES

A. MERCHANT SHIPPING

Comments about the shipping routes and the types of vessels that likely will be employed in some of the major bulk ocean-borne trade movements into the Eastern Bloc have been included in the discussions of important individual commodities while the routes and volumes that are expected to be carried over them have been summarized numerically and graphically in the Summary. In this section we briefly discuss the merchant marine in the Eastern Bloc (principally the Soviet Union), in part to show the degree to which the Eastern Bloc has made itself independent of the Western charter market.

Table VII-1 summarizes the growth in the merchant fleets of the Eastern Bloc nations and illustrates the heavy dependence of these fleets on relatively small vessels. To a large degree, this difference is due to the small size of Eastern Bloc tankers and ore carriers, which results from the fact that the Eastern Bloc does not depend on imports of oil and iron ore to support its industrial base as do the major maritime nations (neglecting flags of convenience).

It may seem strange that Czechoslovakia and Hungary have maritime fleets, but the Czech ships operate largely from Polish ports while Hungarian ships sail from Hungarian ports on the Danube to the Black Sea and East Mediterranean ports. The growth of international ocean freight carried by Eastern Bloc ships is shown below:

OCEAN FREIGHT

(billion ton-km)

	1960	1965	1970	1975
Soviet Union[a]	131.5	388.8	656.1	780.8
Bulgaria[b]	2.5	9.1	38.9	48.1
Czechoslovakia	7.5	8.3	10.5	15.0[d]
East Germany	10.5	30.2	69.7	79.7
Hungary[c]	1.3	1.7	2.7	4.0
Poland	34.8	56.4	106.6	206.1
Romania	1.1	8.4	37.5	50.0[d]
TOTAL	189.2	502.9	922.0	1,183.7

a. Including Caspian Sea, Danube River and domestic coastal and inter-coastal traffic.

b. Including coastal traffic.

c. Including Danube River traffic.

d. Estimated

Source: Central Intelligence Agency.

TABLE VII-1

GROWTH OF THE EASTERN BLOC MERCHANT FLEET

(year end)

	1965			1970			1975		
	Number	Thousand dwt	Average Size dwt	Number	Thousand dwt	Average Size dwt	Number	Thousand dwt	Average Size dwt
Soviet Union	985	7,961	8,082	1,395	11,921	8,546	1,660	15,353	9,249
Bulgaria	60	584	9,733	106	948	8,943	110	1,228	11,164
Czechoslovakia	9	105	11,667	12	138	11,500	14	221	15,786
East Germany	60	550	9,167	130	1,310	10,077	146	1,729	11,842
Hungary	17	23	1,353	16	28	1,750	16	67	4,188
Poland	10	105	10,500	230	2,000	8,696	289	3,866	13,377
Romania	30	170	3,567	50	500	10,000	93	1,182	12,710
TOTAL WORLD	17,825	214,069	12,009	19,503	325,149	16,672	22,391	556,697	24,863

Source: Central Intelligence Agency

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Although far from having the largest or most technically advanced fleet in the world, Soviet merchant shipping has come a long way since 1918 when a few ships were transferred into Sovtogflot by decree of the Congress of the Soviet People's Commissars. By 1925, Sovtogflot had about 130 ships including 3,000-dwt timber carriers and 2,000-dwt passenger-cargo ships that worked the Leningrad-London route and, as long as external trade accounted for only around 1% of total Soviet GNP, the Soviet fleet was of little consequence. While losing half of its ships during the war, the Soviet fleet emerged from World War II at about the same strength as she entered it, having acquired a collection of U.S. lend-lease Liberty ships (39 of which are still active), captured German freighters and some old tankers.

Expansion of Soviet trade immediately after the war centered on Eastern Europe and was mainly landborne. It was only when the Soviet Union began to trade with the industrialized West and with the developing nations of the world that the absolute level and percentage share of trade moving by sea rose sharply. But the Soviet fleet was not up to the demands put upon it and the world charter market reaped the benefits. As a result, between 1950 and 1955 the proportion of Soviet foreign seaborne trade carried in Soviet bottoms fell from 50% to 30%. The Soviets needed ships to haul growing exports of timber and oil, to cope with the uncertainties of its grain harvests, and to satisfy the demands of various foreign aid programs such as those with Cuba and Egypt that could not be entrusted to Western shipping. Reacting to this increased overseas trade and foreign aid activities, it started a shipbuilding program in 1956 to reduce future Soviet dependence on the charter market.

Besides being costly in terms of hard currency expenditures, reliance on the charter market carried with it the possibility of intervention. And the fear of embargoes was not unfounded. After the Cuban missile crisis, Western oil companies adopted a "Black Sea Policy" under which shipowners were encouraged not to charter tonnage to the Soviets who in certain cases had to pay premiums of up to 30%. At the same time, restrictive measures were imposed by the U.S. government against ships carrying any type of cargo to Cuba. Viktor Bakayev, then Merchant Marine Minister, is claimed to have said that, had these economic blockades not been imposed, the Soviet Union would have thought twice about building up its fleet.

Be that as it may, the rapid growth that did take place in the Soviet merchant fleet in the early 1960's raised the Soviet Union from an undistinguished merchant power to one of the major merchant marine nations of the world. Before World War II, the Soviet fleet ranked twenty-third among the maritime nations of the world; by 1966 it had climbed to sixth place. Subsequent expansion has not only kept the Soviet fleet among the leaders of the world but, since 1967 has enabled it to carry more than half of all Soviet foreign trade. At the same time, it maintains 100 ships in the Cuban trade and during the war supported North Vietnam by dedicating over 150 vessels to supplying goods to that country.

The bulk of the Soviet total foreign trade is with the Socialist countries as follows:

CMEA countries	54%
Western industrial countries	31%
Developing countries	15%

Eighty percent of the CMEA traffic is carried by rail and the majority of the intra-CMEA marine traffic is confined to the Baltic and Black Seas. Nevertheless, in 1975 almost 45% of all Soviet exports of 274 million tons and 55% of all Soviet imports of 65 million tons were transported by sea (Table VII-2).

TABLE VII-2

BREAKDOWN OF TOTAL SOVIET FOREIGN TRADE TRANSPORT BY TYPE - 1975

(%)

	Export	Import
rail	29.3	28.3
marine	43.7	54.5
river	4.2	2.9
vehicle	0.1	0.2
pipeline	22.7	14.1

Source: Vneshnyaya Torgovlya SSSR

And, while the percentage of Soviet foreign trade carried by marine transport has declined as a result of the increased use of pipelines, the volume moved has grown steadily. The ton-mile traffic has risen even more rapidly as the distances travelled have increased substantially (Table VII-3).

TABLE VII-3

GROWTH OF SOVIET FOREIGN TRADE CARRIED BY MARINE TRANSPORT

	Weight (million tons)	Volume (million ton-miles)
1940	31.2	12.8
1950	53.7	21.4
1960	75.9	71.0
1970	161.9	354.3
1980 (planned)	220.0	520.0

Source: Vneshnyaya Torgovlya SSSR

As noted earlier, the composition of the Soviet and East European fleets is quite different from that of the other major maritime nations. Table VII-4 points up some of these differences.

General cargo carriers and tankers make up almost the total tonnage of the Soviet fleet, and by Western standards Soviet dry bulk carriers and tankers are considered small and most of its general cargo vessels are technologically inefficient. This is a result of the fact that few Soviet and East European ports are capable of handling dry cargo ships larger than 23,000 dwt, tankers larger than 50,000 dwt, or modern intermodal carriers. Thus, the present composition of the Soviet fleet reflects its historic use in the domestic trade and trade with other Communist Bloc nations which have been slow in developing modern port facilities and therefore did not require a modern, efficient fleet. However, changes in the Soviet fleet are coming rapidly. At the beginning of 1976, Soviet general cargo ships averaged about 7,000 dwt, although the new tonnage ranges from the Slavyansk class (12,900 dwt) to the Chernomor'ye or Zoya Kosmodem'yanskaya class (50,000 dwt). And, while the Soviet tanker fleet at the beginning of 1976 averaged 17,400 dwt, the largest Soviet tanker is the Krym[1] (150,000 dwt) and most of the recently-built tonnage is of the Sofiya class (50,000 dwt).

Current Soviet shipbuilding programs reflect the same composition as in the past. Of the 55 vessels that will be launched in 1977, 43 are dry cargo ships (356,000 dwt), 10 are tankers (437,000 dwt) and 2 are combination carriers (213,000 dwt). However, this will change in the next five years. The U.S. Maritime Administration has projected the size and tonnage of the Soviet merchant fleet over the next 10 years (Table VII-5). This projection shows a building program of 5.1 million dwt and a net gain in fleet size of 3.6 million dwt by 1981 with an additional net gain of 4.4 million dwt by 1986. The construction orders already placed indicate that the Soviet government is emphasizing the new technology of dry cargo/intermodal vessels and is increasing its emphasis on larger tankers and dry bulk vessels.

Besides the Soviet Union itself, Poland and East Germany are the principal shipbuilders for the Soviet fleet. Approximately 670 ships, totalling over 4 million dwt, have come from Polish yards in the last 15 years. Currently, Poland is building a series of 3-deck roll-on/roll-off (ro-ro) vessels and East Germany is building a series of container vessels capable of carrying 730 twenty-foot equivalent units (TEU) containers. Many of the Soviet dry cargo vessels and some of the tankers have reinforced hulls to permit service in northern climates. These ships are aided by a large fleet of icebreakers including three which are atomic-powered -- the 75,000-hp Sibir' and Arktika and the 40,000-hp Lenin.

The availability of maritime workers could present a problem to the Soviet Soviet fleet operations in the future. The growth of general cargo shipments, which are the most labor-intensive, exceeds the growth of

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1. The Krym is designed as a tanker and coal-ore carrier.

TABLE VII-4

COMPOSITION OF SELECTED MERCHANT FLEETS[a] - 1/1/76

(tonnage in thousand dwt)

	Total		Bulk Carriers		Tankers		Combination Passenger and Cargo		General Cargo Carriers		Containerships		Partial Containerships		Roll-on/ Roll-off Vessels		Barge Carriers	
	No.	dwt	No.	dwt	No.	dwt	No.	dwt	No.	dwt	No.	dwt	No.	dwt	No.	dwt	No.	dwt
Soviet Union	1,655	15,353	114	1,647	286	4,980	b	b	1,225	8,559	12	82	b	b	18	85	—	—
Bulgaria	114	1,314	29	384	20	532	4	8	60	376	--	--	1	14	--	--	—	—
Czechoslovakia	13	214	5	160	--	--	--	--	8	54	--	--	--	--	--	--	—	—
E. Germany	152	1,749	18	369	12	513	4	26	116	823	--	--	1	13	1	5	—	—
Hungary	14	64	--	--	--	--	--	--	14	64	--	--	--	--	--	--	—	—
Poland	291	4,220	75	1,613	14	1,001	4	18	187	1,504	--	--	6	63	5	21	—	—
Romania	96	1,197	18	397	7	433	1	2	65	329	--	--	5	36	--	--	—	—
United States[c]	580	15,028	19	544	250	9,475	6	50	138	1,871	107	1,751	28	400	9	128	23	809
W. Germany	611	13,453	79	3,993	83	5,627	4	11	313	2,496	47	650	73	598	11	34	1	44
Japan	2,051	63,238	535	21,270	531	33,950	31	73	894	6,891	52	995	4	34	4	22	—	—
All Countries	22,872	556,572	4,272	150,080	5,311	302,217	714	3,027	11,468	87,598	457	6,657	481	5,081	141	917	28	995

a. Vessels of 1,000 gross tons and over.

b. Included under General Cargo Carriers.

c. Privately owned.

Source: U.S. Maritime Administration; Department of the Navy.

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TABLE VII-5

PROJECTED GROWTH IN THE SOVIET MERCHANT FLEET

	Existing Fleet 1/1/76		Deliveries 1976-1980		Fleet as of 1/1/1981		Fleet as of 1/1/1986	
	Number	Thousand dwt	Number	Thousand dwt	Number	Thousand dwt	Number	Thousand dwt
Dry Cargo Fleet								
Breakbulk	798	6,484.2	90	534.2	777	6,218.8	756	6,050.0
Roll-On/Roll-Off	18	89.2	14	209.4	32	289.4	46	508.0
Container Carriers	12	68.3	15	185.6	20	198.3	42	453.0
Barge Carrier	--	--	2	78.4	2	78.4	6	235.0
Ferryboats	--	27.0	--	22.7	--	49.7	--	--
Bulk Carriers	114	973.7	31	781.0	99	1,616.8	110	2,266.0
Timber Carriers	399	1,832.5	49	290.0	423	2,075.1	450	2,365.0
Reefers	28	127.1	4	23.5	30	142.1	32	157.0
Others	--	33.7	--	--	--	43.6	--	--
TOTAL	1,369	9,635.7	205	2,124.8	1,383	10,712.2	1,442	12,034.0
Tanker Fleet								
50,000 dwt and over	6	510.0	15	1,957.0	21	2,467.0	not available	
40-50,000 dwt	31	1,416.8	11	440.0	42	1,856.8		
20-40,000 dwt	54	1,609.8	18	421.0	72	2,030.8		
10-20,000 dwt	195	1,365.7	16	187.0	191	1,120.3		
less than 10,000 dwt	--	569.1	--	--	--	481.6		
TOTAL	286	5,471.4	60	3,005.0	336	7,956.5	370	10,985.0
GRAND TOTAL	1,655	15,107.1	265	5,129.8	1,719	18,668.7	1,812	23,019.0

Source: U.S. Maritime Administration.

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bulk cargoes by 50%. This has meant rapidly rising labor requirements -- a 34% increase over the past five years -- whereas most industries have been under pressure to utilize their existing workers. Faced with the population pressures to be encountered in the mid-1980's, a shortage of people to handle foreign trade cargo may well develop. To attract workers, the pay for water tranport employees is high (around 213 rubles per month) compared with the average for all workers (146 rubles per month). In fact, water transport employees earn more than any other worker category.

B. PORTS

All merchant marine shipping activities in the Soviet Union are under the direction of one of 16 shipping companies. For example, the Baltic Sea Shipping Company, with headquarters in Leningrad, is responsible for 168 ships which total around 1.4 million dwt and also performs a wide range of shipping services. The company has a passenger fleet, six of which operate regular summer services to major ports such as New York and London; in winter these vessels are engaged in the cruise circuit. During the summer, its fleet of 50 timber carriers handles timber from Baltic and northern ports; in the winter, it carries imports of pipe and other cargo or operates on time charter. The company's tramp vessels are principally employed in Soviet trade with Cuba and importing North American grain, while the liner fleet provides services from Leningrad to many Western nations. The Baltic Shipping Company also has the overall responsibility for the port of Leningrad, including the ship repair facilities serving Leningrad. As part of this responsibility, it maintains a dredging company, a salvage company, a Palace of Culture, a Seaman's rest home and a maritime seaman's school.

For administrative purposes, the 16 shipping companies which together are responsible for the Soviet ports are grouped into three fleets -- Sevzapflot (Northwestern Fleet), Yuzhflot (Southern Fleet), and Dal'flot (Far Eastern Fleet). The various shipping companies and their principal ports are:

SEVZAPFLOT (Northwestern Fleet)

- Severnoye (Northern) - Arkhangel'sk
- Murmanskoye (Murmansk) - Murmansk
- Batiyskoye (Baltic) - Leningrad
- Estonskoye (Estonian) - Tallin
- Latviyskoye (Latvian) - Riga, Ventspils
- Litovskoye (Lithuanian) - Klaypeda

YUZHFLOT (Southern Fleet)

- Dunayskoye (Danube) - Reni, Izmail
- Azovskoye (Azov)- Zhdanov
- Chernomorskoye (Black Sea) - Odessa, Il'ichevsk

Novorossiyskoye (Novorossiysk) - Novorossiysk, Tuapse
Gruzinskoye (Georgian) - Batumi, Poti
Kaspiyskoye (Caspian) - Baku

DAL'FLOT (Far Eastern Fleet)

Dal'nevostochnoye (Far Eastern) - Vladivostok
Sakhalinskoye (Sakhalin) - Kholmsk
Kamchatskoye (Kamchatka) - Petropavlovsk-na-Kamchatke
Primorskoye (Maritime)

While all shipping companies handle many commodities, the share of the traffic carried by some is so heavy as to characterize that company. Thus, the Northern Shipping Company specializes in timber and minerals, the Novorossiysk Shipping Company specializes in oil, the Maritime Shipping Company in wood chips, and the Black Sea and Sea of Azov companies deal primarily in coal, cement and sugar.

Seasonality is an important aspect of Soviet shipping. Traffic peaks in the summer months at all ports in the country and decreases as winter approaches. The ports hardest hit by winter -- those along the Northern Sea Route -- are icebound from November through May and must import everything between June and October. However, most of the southern ports also are affected by the winter cold; most have approximately 100 days per year when ice interferes with shipping.

In the following sections, we discuss some of the activities of the important Eastern Bloc ports, particularly those which handle bulk ocean-borne imports. The overall grain-handling aspects of Soviet ports was summarized in Chapter IV and will not be repeated here.

1. Sevzapflot (Northwestern Fleet)

Sevzapflot (the Northwestern Fleet) encompasses all shipping activities in the northwestern part of the Soviet Union. This includes ports on the White and Barents Seas as well as the several ports on the Baltic Sea. In addition, we have included in this section the Polish and East German Baltic ports which, while they do not come under the authority of the Soviet Sevzapflot, do handle bulk ocean-borne imports in the Baltic Sea.

a. Barents and White Seas

Murmansk, the largest Arctic port in the Soviet Union, is ice-free year-round. It is the largest fishing port in the Soviet Union and handles imports of coal and general cargo, and exports of apatite concentrate, pulp, flax, oil, timber and general cargo. Two 13,000-ton ore carriers can load at a rate of up to 3,000 tons per day in berths of 8.5-meter and 9-meter draft. Altogether there are 19 berths with depths up to 10.5 meters and a new deep water mooring for ore carriers is being built to supplement the present facilities.

Arkhangel'sk, located about 33 miles from the White Sea on the Severnaya Dvina River, is the principal port on the White Sea and the home of the Northern (Sea) Company. The navigational season lasts from May to December, although plans call for it to be made into a year-round port. It is chiefly an export facility for timber, but also handles exports of coal, imports of machinery and general cargo, and coastal trade. There are 35 berths with depths of 7.5-8 meters; the approach channel is 7.75 meters.

Other ports on the White Sea are Keret and Umba which are not open to foreign ships; Mezen, a timber export port open six months of the year; Onega, which is open April to September mainly for timber exports; and Kandalaksha, which handles most of the exports of apatite from the Kola deposits.

b. Baltic Sea

The Baltic Sea serves not only European Russia, Estonia, Latvia and Lithuania, but also East Germany and Poland. The two principal Soviet Baltic ports are Leningrad and Riga, while lesser ports include Vyborg, Kaliningrad, Klaipeda, Tallinn and Ventspils. The principal Eastern Bloc ports are Rostock (East Germany) and Gdansk, Gdynia and Szczecin-Swinoujscie (Poland).

Leningrad, the home of the Baltic Shipping Company, is kept open year-round with the assistance of icebreakers in late winter and early spring. There are berths for 115 vessels of up to 8.5-meter draft. Imports into Leningrad are mostly manufactured goods, including cars and steel, while exports are principally timber, cereals, hides, butter and eggs.

Vyborg, which handles general and bulk cargo, is closed from December to April. This port has 13 berths with depths of up to 8.25 meters and handles about 1.5 million tons per year of cargo.

Tallinn, in Estonia, is kept open all year with icebreaker assistance. It has 19 berths with depths up to 8.25 meters; there are two miles of berthing space. The port imports coal, cotton and machinery, and exports timber, oils and meat.

Riga, the home of the Latvian Shipping Company, is a year-round port on the Daugava River in Latvia which requires the assistance of icebreakers during the last four winter months. There are 16 quays with depths up to 9.7 meters. The port handles both general and bulk cargo, importing textiles, machinery, sugar, fish, food products, metals and chemicals while exporting minerals and manufactured products. There are grain elevators at dockside. Riga is expanding; by 1980 new facilities will be built on an island in the mouth of the Daugava River to handle containers and ro-ro cargoes which will increase Riga's capacity by approximately 50% to 7 million tons per year.

Ventspils, in Latvia at the mouth of the Venta River, is open all year. There are 13 berths with depths up to 11.5 meters. Currently, imports include textiles, machinery and sugar; exports include food products, metals, coal, timber and asbestos. The deep water pier now under construction will allow several ocean-going tankers to moor simultaneously and when completed will make Ventspils Latvia's biggest port exporting oil, gas and potash. An oil pipeline from Soviet producing areas will terminate at Ventspils.

Klaypeda, in Lithuania, has 15 berths with depths up to 9.75 meters and handled over 6 million tons of cargo in 1975. The port imports sugar, fish and metals, while exporting chemicals, coal, coal tar and pitch. Reconstruction of existing facilities and construction of a new harbor is underway.

Kaliningrad (formerly Koenigsberg) is located on the Pregel River near where it empties into the Gulf of Danzig. It is not open to foreign shipping.

Szczecin-Swinoujscie. This is the largest port complex in Poland handling 23 million tons of cargo in 1975 compared with 16 million tons in 1970. Approximately one-third of the tonnage handled is imports while two-thirds is exports. This port complex handles imports of ores and fertilizer, and exports of coal, grain, salt and general cargo. Both Czechoslovakia and Hungary utilize this port for sea-borne foreign trade.

Gdansk (formerly Danzig) has handled increasing tonnages of cargo in recent years, rising from 10 million tons in 1970 to over 18 million tons in 1975. Roughly one-quarter of the total tonnage handled is imports. Gdansk has 12 quays with special terminals for handling iron ore, coal, solid and liquid sulfur, timber, fertilizers and grain. The new North Port ore terminal presently under construction will be able to handle vessels of up to 100,000 dwt. Gdansk also is the principal shipbuilding center of Poland, accounting for about 60% of total production.

Gdynia was built in 1921 as a coal shipping port and in recent years has grown as dramatically as Gdansk, going from 9 million tons in 1970 to 13 million tons in 1975. Approximately 40% of the total tonnage handled is imports and 60% is exports. Gdynia imports the same commodities as Gdansk while the principal exports are coal, cement and food products. Gdynia has six basins and two channels with 16 quays. It also has a container terminal and can handle ro-ro vessels.

Kolobrzeg, located 50 miles east of Swinoujscie, is primarily a Polish fishing port. However, it also handles imports of general cargo and exports fish products, coal and grain.

Port Polnocny in Poland is a coal shipping port capable of handling ships up to 100,000 dwt. It also is being developed as a crude oil and petroleum port with an annual capacity of 6 million tons for the first stage. The port will be able to handle tankers up to 150,000 dwt.

Rostock, East Germany's largest port, is divided into three ports: Rostock-Warnemunde, Rostock-Uberseehafen and Rostock-Stadt. Rostock-Warnemunde has been selected to become the principal East German port and a new deep harbor and oil terminal have been built to handle ships up to 35,000 dwt. A new high-capacity railway and a superhighway are under construction to link Rostock with East Berlin. The development of Rostock has drawn away Hungarian and Czechoslovakian traffic from Polish ports.

Rostock-Uberseehafen can handle container and ro-ro vessels. It also has bunkers and tanks for storing bulk cargoes and oil shipments and has the fourth largest marshalling yard in East Germany. The largest oil tankers presently able to use the port are 33,000 dwt.

Rostock-Stadt is the smallest of the three Rostock ports with one mile of quay and one grain elevator.

Wismar was the leading East German port until the early 1960's when Rostock was developed. The ports of East Germany were unimportant before World War II since the industry located in what is now East Germany was supplied primarily through Hamburg and Danzig (now Gdansk). With the development of Rostock, Wismar has declined but still remains an important bulk cargo port. It has specialized areas for cargo, grain, potash, oil, timber and fishing vessels.

Stralsund is a small East German port used in Baltic trade mostly by Scandinavian ships.

2. Yuzhflot (Southern Fleet)

Yuzhflot (the Southern Fleet) includes the shipping activities of four groups of ports: those on the Black Sea, those on the major rivers -- the Danube and Dnieper -- which flow into the Black Sea, those on the Sea of Azov, and those on the Caspian Sea.

In addition, we have included in this section the Bulgarian and Romanian ports which, while they do not come under the authority of the Soviet Yuzhflot, have been included in our estimates of bulk ocean-borne exports into the Black Sea. It should be noted that Czechoslovakia and Hungary also are served by water from the Black Sea via the Danube River.

a. Black Sea

Odessa, located at the north end of the Black Sea, has year-round navigation, although some icebreaker assistance is needed in January and February. The port handles imports of coal, cotton and machinery, and exports of

grain, sugar, timber and wool. There are 38 berths with depths up to 12 meters and a dockside elevator. Odessa, the headquarters of the Black Sea Shipping Company, handles about 7 million tons of cargo per year. Odessa is the main grain port in the Black Sea, handling nearly one-third of U.S. grain exports to the Soviet Union in 1973. The Black Sea Shipping Company is the largest dry cargo ship operator in the Soviet Union and controls 80% of the Soviet passenger fleet.

A bauxite import terminal is being built in the Odessa/Nicolayev range. To be completed in 1978, the facility reportedly will be able to handle vessels of 100,000 dwt and unload them at a rate of 3,600 tons per hour.

Nikolayev, located approximately 50 miles up the Yuzhnyy River from the Black Sea, has 28 berths. The port is among the largest in terms of grain storage capability with two large elevators and an estimated capacity of 150,000 tons of grain.

Tuapse is open year round. Its 11 berths have depths up to 9 meters. Oil is the chief export, but Tuapse also handles metals and general cargo. Tuapse will share in 5 km of new piers with four other ports during the 1976-1980 five-year plan.

Grigoryevskiy, near Odessa, soon will become a giant chemical port. This facility, which will handle ships up to 200,000 dwt, is being built to service the long-term contract concluded with Occidental Petroleum for the exchange of chemical and fertilizer products.

Il'ichevsk is a new Black Sea port located near Odessa. It has 16 berths with depths of up to 11 meters. New piers will be built at Il'ichevsk over the next five years and a new container terminal, which each hour will be able to handle 45 TEU containers, will be operational in 1978. Intentions are to make Il'ichevsk one of the three principal container ports in the Soviet Union. (The other two are Leningrad and Vostochnyy.)

Novorossiysk is a year-round port with two harbors -- one for dry cargo and the other (Shekharis) for oil. Together these two harbors have 35 berths; the dry cargo berths have depths up to 11.5 meters while the oil tanker berths have depths up to 14.5 meters. There is a grain elevator, loaders and pipelifters. The port imports machinery and general cargo and is the largest Soviet port for the exportation of oil and cement. Construction is taking place at the oil harbor so it can receive tankers of up to 200,000 dwt. The Novorossiysk Shipping Company is a tanker company with a crude tanker fleet of 3.5 million dwt mainly engaged in the long haul tanker trades, but also is involved in the carriage of oil products and wine.

Poti enjoys year-round navigation at its 15 berths with depths up to 9.5 meters. Poti exports manganese ore and grain, and handled approximately 5 million tons of freight in 1976.

Batumi is on the east coast of the Black Sea just north of the Turkish border and has year-round navigation. It imports pig iron, other metals and machinery, and exports oil, timber and grain. Its 12 berths have depths up to 10.3 meters.

Constanta is the principal Romanian port on the Black Sea. However, the Danube, which cuts through the eastern part of Romania and forms its southern border, is Romania's main waterway, and most of the ocean-borne traffic destined for Romania is handled through the Soviet ports of Izmail and Reni on the Danube. There was a plan to dig a 30-mile canal from the Danube to Constanta, but this was abandoned in the early 1950's and, although modernized in the early 1960's, Constanta has not grown as rapidly as many ports on the Black Sea.

Bourgas in Bulgaria can handle ships up to only 15,000 dwt, but a tanker terminal three miles southeast of the port can handle up to 70,000-dwt tankers.

Varna and Varna-West, the other Bulgarian port facilities located 13 miles from Varna, handle grain, ore and general bulk cargoes.

b. Danube and Dnieper Rivers

The ports on the Danube River are significant in that they serve the land-locked nations of Czechoslovakia and Hungary as well as the Soviet Union and Romania.

Izmail, about 75 miles up the Danube from the Black Sea, is accessible all year, with the assistance of icebreakers in the winter. There are eight quays with depths of 7.5-8.25 meters which handle grain, oil and timber. There is a grain elevator.

Reni is about 90 miles up the Danube from the Black Sea, but it handles small ocean-going ships. Its 12 quays, with depths up to 8.25 meters, handle oil, general and bulk cargoes. This year-round port has just completed a specialized complex for processing timber which, with other new mechanization, will increase the amount of freight handled by 1 million tons per year.

Kilia, about 30 miles up the Danube, is less important than Izmail and Reni. Icebreakers keep Kilia open to navigation all year. There is an elevator for grain and ships with drafts up to 8 meters can be handled.

Kherson, about 45 miles up the Dnieper from the Black Sea, has year-round navigation with the assistance of icebreakers. There are 10 berths with depths up to 8.4 meters to handle general and bulk cargoes.

c. Sea of Azov

The Sea of Azov is an extension of the Black Sea and at present there is free travel between the two. Because of the rivers flowing into it, the Azov Sea always has been less saline than the Black Sea, but the recent industrialization on the Don River has reduced the amount of fresh water flowing into the Azov which, in turn, has caused more water to flow from the Black Sea into the Azov Sea, increasing its salinity

and reducing the fish catch. Consequently, consideration is being given to constructing a bridge-dam to reduce the exchange of water between these two seas. However, this will not necessarily affect imports into the Sea of Azov since vessels will be able to pass under and through this structure.

Zhdanov is a year-round port with 24 berths and depths up to 7.75 meters. There are two harbors, one specifically for grain which is this port's principal export. Coal and oil are also exported. A special coal-loading complex, which reportedly can handle 17,000 tons per day, was opened in 1972 and ro-ro ships were first handled in 1975. Container operations cover 10,000 m^2.

Berdiansk, in the Sea of Azov, is navigable all year, but needs icebreaker assistance in the winter months. It has 10 berths with depths up to 7 meters.

d. Caspian Sea

Despite its land-locked position, the Caspian Sea serves as a route for international import/export traffic which travels via internal waterways from the Baltic Sea to Iran. Traffic on this route picked up noticeably after the closing of the Suez Canal, but continued when the canal reopened.

Baku, the principal port on the Caspian Sea, each year handles several million tons of grain, industrial equipment and oil products.

3. Dal'Flot (Far Eastern Fleet)

The Pacific coast of the Soviet Union is vast, but it has comparatively few ports because of the sparse population and lack of industrialization in the Far East. The major ports on the Pacific coast are Vladivostok, Nakhodka, Vostochnyy and Nagayevo, although a number of lesser ports serve special interests.

Vladivostok is the home of the Far Eastern Shipping Company which imports and exports goods to and from the entire Pacific Coast as well as many foreign countries. The port contains a total of 40 berths. This is a busy port with over 700 ships visiting during a five-month period in 1976. The Vladivostok tanker fleet is expected to reach 12 tankers by July of 1978. Vladivostok also is the home of the Pacific Scientific-Research Institute of Fishing and Oceanography which has recently moved into new accommodations.

Nakhodka, on the western shore of Amerika Bay about 60 miles southeast of Vladivostok, is the largest Soviet port on the Pacific Coast and handled 7.5 million tons of cargo in 1971. It is a general cargo and fishing port, and also can handle containerized cargo. The port contains a total of 37 berths, one of which is along a grain quay. It will soon be exceeded in size and activity by Vostochnyy, under construction 8 miles across the bay.

Vostochnyy, located directly across Amerika Bay from Nakhodka in Vrangel Bay, is a new deep-water port facility. Construction started in mid-1971 and the port received its first ship -- a timber carrier -- in December of 1973. Developed with the help of an $80 million credit from the Japanese for the purchase of Japanese equipment, this is the single largest Soviet port construction project currently under way. Vostochnyy is expected to handle 35 million tons per year of cargo when construction is completed. This will make Vostochnyy about four times the present size of Nakhodka and one of the larger, if not the largest, Soviet ports in terms of cargo-handling capacity.

Vostochnyy is principally an export facility designed to serve the Japanese market. It has special facilities to handle exports of timber, wood chips, coal, oil and containerized cargo. It also will receive westbound containers destined for the Trans-Siberian Landbridge. The recently-finished container terminal reportedly is capable of handling 70,000 containers per year, making it the largest such facility in the country. Although initially an annual capacity of 120,000 containers was planned, ultimately Vostochnyy each year will handle 600,000 TEU containers through eight container and two ro-ro berths. By the end of 1978, the coal loading complex, with a capacity of 5 million tons per year, will be able to load vessels of 100,000 dwt with coal at a rate of 8,000 tons per hour. The wood chip complex can load 800,000 tons per year, while 400,000M^3 of timber can be loaded each year.

Chadaudzha is an oil terminal being built near Nakhodka as the Pacific terminus of the Krasnoyarsk/Irkutsk crude oil pipeline now under construction. Completion, including construction of oil docks, refineries, etc., is expected in 1978.

Kholmsk is one of the lesser Soviet ports which is growing because of off-shore exploration activity. Kholmsk has three sections -- one to handle merchant vessels, one for fishing vessels, and one to serve local off-shore petroleum and gas prospecting activities.

Nagayevo, located near the city of Nagadan, serves the northeastern region of the Soviet Union and is kept open year-round. About 60% of all the freight in and out of Magadan Oblast is handled through Nagayevo. Magadan is an expanding and developing region economically, and construction at the port is being undertaken to facilitate that development. The port has five moorings capable of handling 2.6 million tons of freight per year. Nagayevo will share with other ports in the construction of over 5 km of new moorings between 1976 and 1980. A container terminal was started in February, 1976, as part of the reconstruction work under way there.

C. SOVIET TRADE ROUTES

The Soviet merchant marine is active in many traditional trade routes. While being justifiably criticized for cutting rates to gain acceptance on a particular route, once it has been accepted as a conference member it apparently follows the established rules. Nevertheless, this aspect

of the growing Soviet merchant marine is of considerable concern to the traditional maritime nations of the world because of both its long-term commercial and military implications. However, it is not competition on the traditional sea routes that is of concern in this study, but rather certain other aspects of Soviet trade that are important to consider for their potential impact over the next 25 years.

1. Port Access Agreements

An important adjunct to Soviet maritime shipping has been the development of a worldwide network of harbors and port facilities to which the Soviet Union has formally obtained access. With over one-half of the world's gross registered tonnage of fishing vessels operating in virtually all major oceans, the fishery agreements that the Soviet Union has concluded with 52 nations provide a vital key to the fleet's operations. Developed principally with countries of the third world, these agreements give Soviet vessels the right to use the harbors, repair facilities and supplies of the countries involved.

Typically, the foundation for such agreements are laid by first signing an aid or trade pact with the country. This is followed by a fishery agreement, or in some cases an agreement on a shipping line which stipulates that Soviet ships have guaranteed bunkering and repair facilities. Often, the agreement is combined with some form of investment in port installations, training, etc.

The choice of partners for these agreements often suggests a global strategic plan. In Africa, for example, agreements are in effect with Algeria, Egypt, Yemen, Somalia, Mozambique, Madagascar, Tanzania and Guinea. And it has been hypothesized that Angola would be a desirable addition. In the Far East, there are installations at Vishakhapatnam in India, Dacca and Chittagong in Bangladesh, in the Andaman Islands, at Hanoi, Pyongyang, etc.

Besides the commercial advantages, there are obvious military advantages to be gained by maintaining such agreements, advantages that are only accentuated when one remembers the Soviet lumber carriers with long hatches and powerful cranes that can be rapidly converted to transport rockets,[2] the ro-ro ships built with strengthened decks that can carry large and heavy vehicles, the fleet of passenger and cruise ships that can go straight over to troop carriers, and the large factory trawlers that can easily switch from serving catching boats to serving landing craft.

2. The Trans-Siberian Landbridge

The Soviet Trans-Siberian Landbridge for containerized cargo is one of the more important shipping developments in recent years. While not handling strictly bulk cargo nor cargo that is essential to the Soviet

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2. It was such ships that were used during the Cuban missile crisis.

economy (except insofar as it generates hard currency), the landbridge apparently is destined to handle a major traffic flow that, if disrupted, could have implications for both Eastern Bloc and Western shipping.

When first inaugurated, while the Suez Canal was still closed, the 6,000-mile landbridge was a substitute for the 17,000-mile sea route around Africa to the Far East. In the early years of operation, the landbridge earned an unenviable reputation for slow delivery, lost containers, and poor port handling facilities -- all at a cost that was not low enough to counteract these problems.

With effort, these difficulties have been largely eliminated. Container tracking now is controlled by computer, handling and port facilities have been improved at both ends, particularly at Nakhodka, and the whole rail system finally has been double tracked so that trains bound in one direction need no longer wait for opposite-bound trains to pass. Costs also have been reduced by grouping container cars into block trains. And, to reassure customers, the freight cost is refunded if the advertised transit time is exceeded. The success of this system -- 70,000 containers were transported in 1975 -- has surpassed even Soviet short-term expectations. However, this level still is far below the 1980 plan -- 300,000 TEU containers -- and below the ultimate expectations suggested by plans to raise the capacity at Vostochnyy to 600,000 containers per year.

However, all of these improvements can do little to alleviate one of the major problems in any transportation system -- balancing demand in both directions. For example, during the recent trade slump when Japanese exports held up while European exports fell, an imbalance of about four to one was created in favor of the westbound container traffic. In 1976, about 50,000 containers were transported from Vostochnyy to the western border of the Soviet Union, while 18,000 containers were handled eastbound.

3. The Northern Sea Route

The Northern Sea Route, which stretches from Murmansk across the top of the Soviet Union to the Pacific Ocean, has long fascinated Soviet mariners. At this time, the only active portion of the Northern Sea Route is the western half which serves ports on various Siberian rivers including Dudinka, Igarka, and other ports on the Yenisey. Igarka is the principal timber exporting port of the Soviet Union. Located 350 miles south of the Kara Sea, it handles ships from around the world. Dudinka, about one-third of the way between Igarka and the Kara Sea, also is a critical component of its region, handling in just the five summer months virtually all[3] of the incoming food, construction materials and other goods required by the Noril'sk Mining-Metallurgical Combine and its population of almost

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3. That is, all except those items flown in by air.

200,000 people as well as the outgoing copper, nickel and concentrate output of that Combine. While a significant portion of the Dudinka imports consists of foreign goods, particularly machinery, equipment and construction materials, these are all handled by Soviet vessels since this port is closed to foreign shipping.

So far, the spasmodic attempts to utilize the full length of the Northern Sea Route to serve the Far East (6,000 miles from Murmansk to Japan) have failed but, with the introduction of atomic icebreakers and their success in prolonging the navigation season on the Murmansk-Yamal run, the Northern Sea Route is again being seriously studied by Soviet maritime interests. While the development of the Northern Sea Route would not involve much bulk import cargoes, it would facilitate exports from and therefore development of Eastern Siberia.